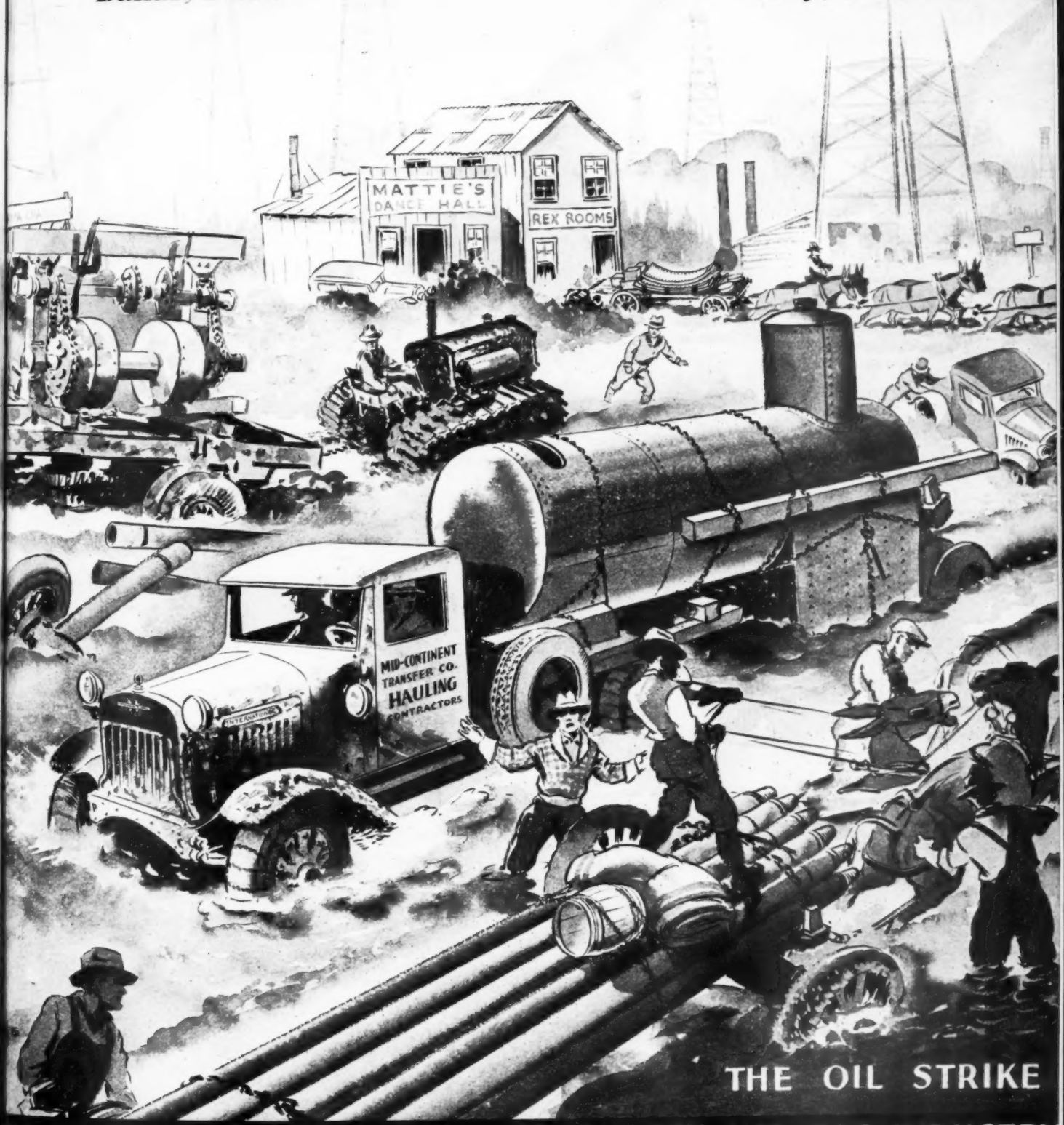
THE Petroleum Engineer

Dallas, Texas

July, 1932



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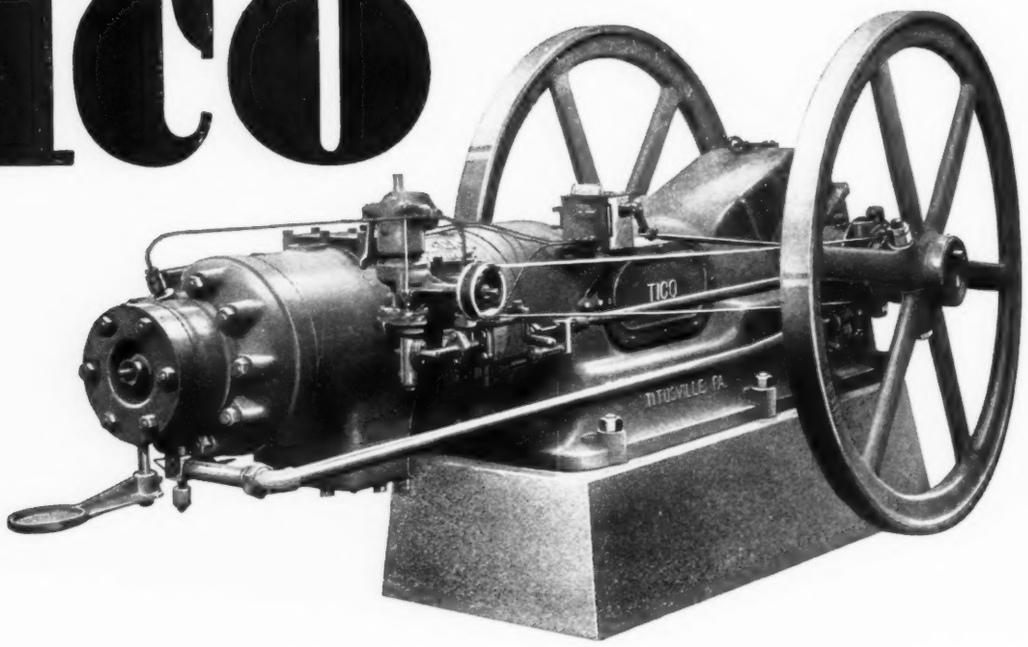

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The Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Edited and Circulated Only for those Actively Engaged in the Operating Departments of the Industry

Published 13 times a year; monthly on the 15th with the exception of June, in which two issues appear—the Engineering Review number on the first and the regular June issue on the 15th.

SUBSCRIPTION PRICE
Single copies 15 cents. Domestic and foreign, $1.00 per year, with the exception of Canada, where the price is $1.65 per year.

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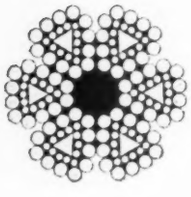
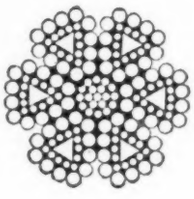




The Month's HIGH LIGHTS in OILDOM

By J. L. DWYER

A NOVEL situation developed last month, when K. R. Kingsbury, president of the Standard Oil Company of California, announced that, provided oil production was placed within the figure which the market was capable of assimilating, his company would increase the price of crude oil twenty-five cents a barrel. The output of the California fields was reduced to the prescribed figure, and the price was advanced on June 26.

As this is written (July 9th) there seems to be some danger of upsetting the California situation, and some fields have exceeded their allotted production. The general petroleum condition in California is admittedly grave, and the recent advance in the price of crude was extremely helpful. It would seem unfortunate if the constructive work of last month were to be nullified by conditions which would result in the restoration of the former crude price.

An encouraging note is found in the report that the consumption of petroleum products is exceeding the figure anticipated by the American Petroleum Institute's committee on economics. The fate of the petroleum industry this year depends upon consumption more than at any time in recent years.

Texas still dominates the producing situation, and East Texas is still the most active spot in the nation. The present status of East Texas allows each well to produce fifty barrels daily until July 16th. It is believed that the total daily output of the field will be held close to the present figure of 325,000 barrels for the next few months. Wells are being drilled into the sand very rapidly, and last month 1,163 wells were completed in East Texas. The figure is approximately three-quarters of the number of wells completed in the entire United States.

On July 11, hearings are to be held before the Texas Railroad Commission to investigate the producing status of several other fields in the state. An effort is being made to hold the daily production per well of other flush fields to a figure comparable to that of East Texas.

Throughout the current year the daily production of oil in the United States has been held well in hand. At the present time the output is 300,000 barrels daily less than it was one year ago, and if the present level be maintained, August should witness this figure increased to 500,000 barrels. The highest point of last year's production was touched in August, just before martial law was invoked in the fields of Texas and Oklahoma. Taken in its entirety, the producing situation strikes a healthy note.

From the standpoint of equipment, an improved situation is evident, and the majority of the manufacturers and distributors report increased sales. What is believed to be the first large order for pumping equipment in the East Texas field was placed last week, and a continuation of this practice is to be expected. Many of the companies in East Texas have decided to install foundations for pumping equipment before the fall rains start. It is interesting to observe that the majority of the material and equipment purchases recently made for this field specify material which may be utilized for five and even six thousand-foot wells.

Since the recent Canadian tariff on gasoline, much activity has been apparent in refinery construction in the Maple Leaf land. Contracts for several plants have been awarded, and reports indicate a continuation of this activity.

Oklahoma fields made the front pages again when Governor Murray once more inaugurated the battle of Oklahoma City by placing that area under martial law.

Production and Refining Figures Furnished by the American Petroleum Institute

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending June 25, 1932

(Figures in Barrels of 42 gallons each)

DISTRICT	Per Cent Potential Capacity Reporting	Daily Avg. Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Gasoline Stocks	Gas and Fuel Oil Stocks
East Coast	100.0	498,000	78.6	19,244,000	7,199,000
Appalachian	91.8	101,300	73.7	2,304,000	1,075,000
Ind., Ill., Ky.	98.9	290,800	67.4	8,058,000	4,139,000
Okla., Kans., Mo.	89.6	217,600	50.0	5,096,000	3,408,000
Texas	91.2	527,200	68.8	7,614,000	9,979,000
Louisiana-Arkansas	98.6	160,500	69.6	1,723,000	5,149,000
Rocky Mountain	89.4	35,300	24.5	1,843,000	683,000
California	96.7	481,300	54.4	16,091,000	98,232,000
Total Wk. June 25	95.1	2,312,000	63.1	61,973,000	129,864,000
Total Wk. June 18	95.1	2,405,900	65.7	64,031,000	129,398,000
The Texas and Louisiana Gulf Coast figures shown below are included above in the totals of their respective districts					
Texas Gulf Coast	99.8	420,600	79.1	5,856,000	7,425,000
La. Gulf Coast	100.0	109,800	74.4	1,527,000	4,375,000

Daily Average Production

(Figures in Barrels)

	June 25, 1932	May 28, 1932	June 27, 1931
Oklahoma	426,900	399,150	544,300
Kansas	98,300	86,900	102,100
Panhandle Texas	55,850	51,550	59,450
North Texas	50,400	51,550	60,350
West Central Texas	24,400	25,450	29,550
West Texas	178,950	183,900	209,850
East Central Texas	57,350	56,900	59,800
East Texas	331,800	334,300	359,700
Southwest Texas	56,000	54,600	58,650
North Louisiana	29,850	29,250	35,700
Arkansas	34,000	34,300	44,200
Coastal Texas	116,450	113,650	140,000
Coastal Louisiana	31,900	33,900	23,250
Eastern (not including Mich.)	104,650	108,250	100,750
Michigan	17,650	19,200	7,850
Wyoming	35,000	38,200	40,150
Montana	7,200	8,650	7,600
Colorado	2,950	3,300	4,650
New Mexico	36,100	36,700	44,550
California	460,400	489,700	509,500
TOTAL	2,156,100	2,169,400	2,441,950

NOTE: Stocks at refineries, except in California district, which includes stocks of finished gasoline and engine distillate at refineries, water terminals and sales distributing stations and amounts in transit thereto.

Hobbs Pool Potential Established

Potential of the Hobbs, New Mexico, pool was established at 1,004,061 barrels for the next ninety days at a meeting of the field's advisory committee in Dallas. This figure was adopted on the recommendation of Umpire C. G. Staley, following a study of wells in the fields for the purpose of discovering pressure declines.

The pressure decline and the potentials are 13.86 per cent below the figure of January, 1931, which has been the basis for the field since that date. There are 157 producers in the field, with outlet reported as 29,339 barrels daily.

The committee did not take up the matter of the proposed unitization of the pool, data on which has been assembled by an engineer's committee.

Meters for the Oklahoma City Field Lines

Governor Murray of Oklahoma has extended his military law zone to include storage tanks and pipe lines. In addition he has created a proration board of five members. He asserted this was necessary as orders of the State Corporation Commission were being violated.

The proration board will hold hearings to fix production allowables, but all orders will be subject to the Governor's approval.

Governor Murray further ordered that each and every pipe line owner, manager or operator of pipe lines transporting oil out of the Oklahoma City field equipped their lines with meters sufficient to measure the amount of oil flowed through the line. This action was to be taken before August 1st.

The order also provided that thirty national guardsmen should patrol the field, working in three eight-hour shifts.

The expense of the board and the guardsmen will be borne by the oil producers on a prorata basis. Every producer is assessed a quarter of a cent per barrel of oil produced and unless this amount is paid by the tenth of each month the wells of the negligent producer shall bt shut in until the operator has fully paid the assessment.

New Deep Hole Record for United States

Western Gulf Oil Company has marked up a new deep hole record for the United States, with its Bradley No. 1, north of the old Santa Maria, California, field which has reached a depth in excess of 10,150 feet. Drilling is continuing with an open hole from 5,990 feet, where a string of five and three-fourth-inch casing was set.

This well is more than 100 feet deeper than the previous deep test in California, and exceeds the depth of the Mid-Kansas and Ramsey well at Cement, Okla., by nearly seventy-five feet. The deepest well in the world is in Mexico, where a test was completed to 10,585 feet last year.

Launch War on Substitution Evil

Representatives of oil companies marketing motor fuels and lubricants in the New York area made plans at a meeting recently held at American Petroleum Institute headquarters to combat substitution of products sold to motorists.

Consideration was given the possibility of prosecuting such cases under a state law prohibiting substitution of unknown or unnamed motor fuels and lubricants in storage.

Preliminary investigation in Brooklyn has revealed, it was reported, that other petroleum products are being substituted for branded goods in the filling stations there. Some companies already have prosecuted known cases, and others have withdrawn dispensing equipment from accounts believed to be chronic violators of the substitution law. The "substitution racket" has been uncovered in other localities and has been brought to the attention of law enforcement officers. Recently in Texas, the Dallas Better Business Bureau launched a campaign against filling station operators who were substituting petroleum products.

Five-Day a Week Plan Adopted

Standard Oil Company of New Jersey has adopted the five-day week plan for its employes. The announcement was made from the New York offices of the company. By adopting this plan, company officials explain that it will not only keep its 43,000 employes at work but it is hoped would provide places for new workers. Salaried employes, including executives, will have their compensation reduced one-eleventh.

Shell Oil Company of California has adopted the five-day week plan in all its departments throughout the state. Some divisions, such as field and plant departments, have been on this basis for some time, but according to present plans the program is being universally adopted in all departments.

Kettleman Hills Crude Goes to France

The Union Oil Company has closed a contract with the Bowring-Hardy Company, whereby Kettleman Hills, California, high gravity crude oil is to be shipped to Porte de Beauduc, refinery port in the Gulf of Lyons, near Marseilles, France.

This contract marks the entry of French refining interests on the Pacific Coast. This contract will permit the French refiners to fulfill the policy of their government, which is to allow crude oils to enter free, while applying a heavy duty to refined products. The crude is admitted free so as to permit expansion of French refineries and to allow them to operate and protect the markets already built up in various French provinces.

France controls concessions in the Iraq field, but until the Iraq pipe line is completed they will no doubt seek their crude supplies in the United States.

Gasoline Taxes Reach Maximum of 11c a Gallon

Motorists of the United States now are paying taxes on gasoline at rates ranging from 3c to 11c a gallon. The end of the 2c tax rate came on June 21, the date when the new federal gasoline tax became effective.

Pyramided taxes are largely responsible for the present high

rates. The 11c tax is peculiar to Alabama, where in certain localities motorists pay a 1c federal tax, 5c state tax, 3c county tax, and 2c city tax. The next highest rate is 9c a gallon, collected from motorists in Florida, where there is a federal tax of 1c, state tax of 7c, and city tax of 1c.

Here's the lineup regarding total gasoline tax rates:

3c tax, 2 states and the District of Columbia; 4c tax, 13 states; 5c tax, 17 states; 6c tax, 7 states; 7c tax, 5 states; 8c tax, 2 states; 9c tax, 1 state; and 11c tax, 1 state.

The federal tax on lubricating oil, amounting to 4c a gallon, is now in effect. It is estimated this levy will produce $33,000,000 in 1932, of which only a part will be paid by motorists, the greater volume of lubricants being consumed in industry. However, the motorists are expected to turn over to the federal government $150,000,000 in federal gasoline taxes. They provided $536,497,000 for the states in gasoline taxes last year, and may be expected to increase that amount in 1932. All of which means the 1932 gasoline tax bill will be about $692,500,000.

Motor Fuel Demand Over Two Months' Estimate

The consumption of motor fuels is holding up at a rate a little in advance of forecasts, it was reported to the Board of Directors of the American Petroleum Institute. The Institute's committee of nine, designated to forecast the probable consumption of motor fuels for the last nine months of the year, beginning with April, estimated at the mid-year meeting of the organization, held in Tulsa, Okla., that consumption would decline 6.6 per cent from last year's figures. At that time there were expressions of belief that the 1932 decline would be materially sharper.

For April and May, however, Fred Van Covern, Institute statistician, reported to the directors that consumption was roundly 800,000 in excess of the committee's estimate. For April the consumption was 34,454,000 barrels, as against a forecast of 34,250,000 barrels, according to the Bureau of Mines report. Based on reports received by the American Petroleum Institute, consumption for May was 38,500,000 barrels, as compared with an estimate of 37,900,000.

U. S. Exhausting Petroleum Reserves

The United States will be the first country in the world to exhaust its petroleum reserves unless the present waste in production and consumption is curbed, C. B. Ames, vice-president of the Texas Company, recently told the Institute of Public Affairs at the University of Virginia.

Judge Ames' warning came in the course of an address in which he urged federal legislation permitting the oil industry to determine in advance the legality of trade conferences and agreements on conservation of the crude supply and moderation of marketing and consumption methods.

"The United States is producing approximately 70 per cent of the crude oil produced throughout the world and is consuming approximately 70 per cent," Judge Ames said. "It possesses probably less than 50 per cent of the world's reserves. On the present basis of production and consumption, therefore, our petroleum reserves will be exhausted first. Notwithstanding this grave situation, these resources are being wasted."

The speaker declared that two billion cubic feet of natural gas was blown into the air daily in 1931 while only one billion cubic feet was used by domestic consumers. Because the industry is manufacturing too much fuel oil, he continued, this fuel oil is displacing coal, with the result that railroads are being deprived of their legitimate revenues from coal tonnage. This oil should be saved and made into gasoline instead of being devoted to this inferior use."

This waste in production and consumption, Judge Ames indicated, is traceable to lack of workable legislation. He said a difference of opinion among oil men on the legality of limiting production and storage to the gasoline requirement forecasts as drawn up by the Federal Oil Conservation Board, has thwarted any such course of action lest the oil operators be attacked by some attorney general.

Permit Gasoline Extraction Without Utilization of Residue

The Texas Railroad Commission has granted Hagy, Harrington & Marsh, Texas Panhandle gas producers, a permit to erect a gasoline extraction plant on their properties in the Panhandle and have set aside the requirement, previously enforced, that the residue gas be utilized. This permit was granted shortly after a three-judge Federal court had declared void the common purchaser law applying to natural gas, on which independent operators had relied for a market outlet.

In granting the permit the Railroad Commission order made the comment that "the only thing to do is to permit the independents to use their gas for other purposes under such restrictions as may seem necessary to the commission."

This action may mean that a number of independent gas producers will apply for permits to extract gasoline from their gas production without utilizing the residue gas. The majority of the independent gas properties in the Panhandle have not been producing due to the lack of any outlet for the gas.

Would Curtail Crude Production Ten Per Cent

A proposal that oil production in all non-prorated fields of Kansas, Texas and Oklahoma be curtailed 10 per cent has been made by Thurman Hill, Public Service Commissioner of Kansas, to the operators of these three states.

Hill said that Oklahoma producers were in a "receptive mood." Hill is of the opinion that a 25-cent per barrel increase in the posted price of Mid-Continent crude would be made if the production of the United States is curtailed to 2,000,000 barrels daily.

Plan Second French Refinery

Campagnie Française des Petroles is understood to have acquired land at Martigues in the south of France for the purpose of erecting a second refinery. This company is at present erecting a plant near Havre in northern France, which is expected to be completed during 1933.

Latest Activities in the

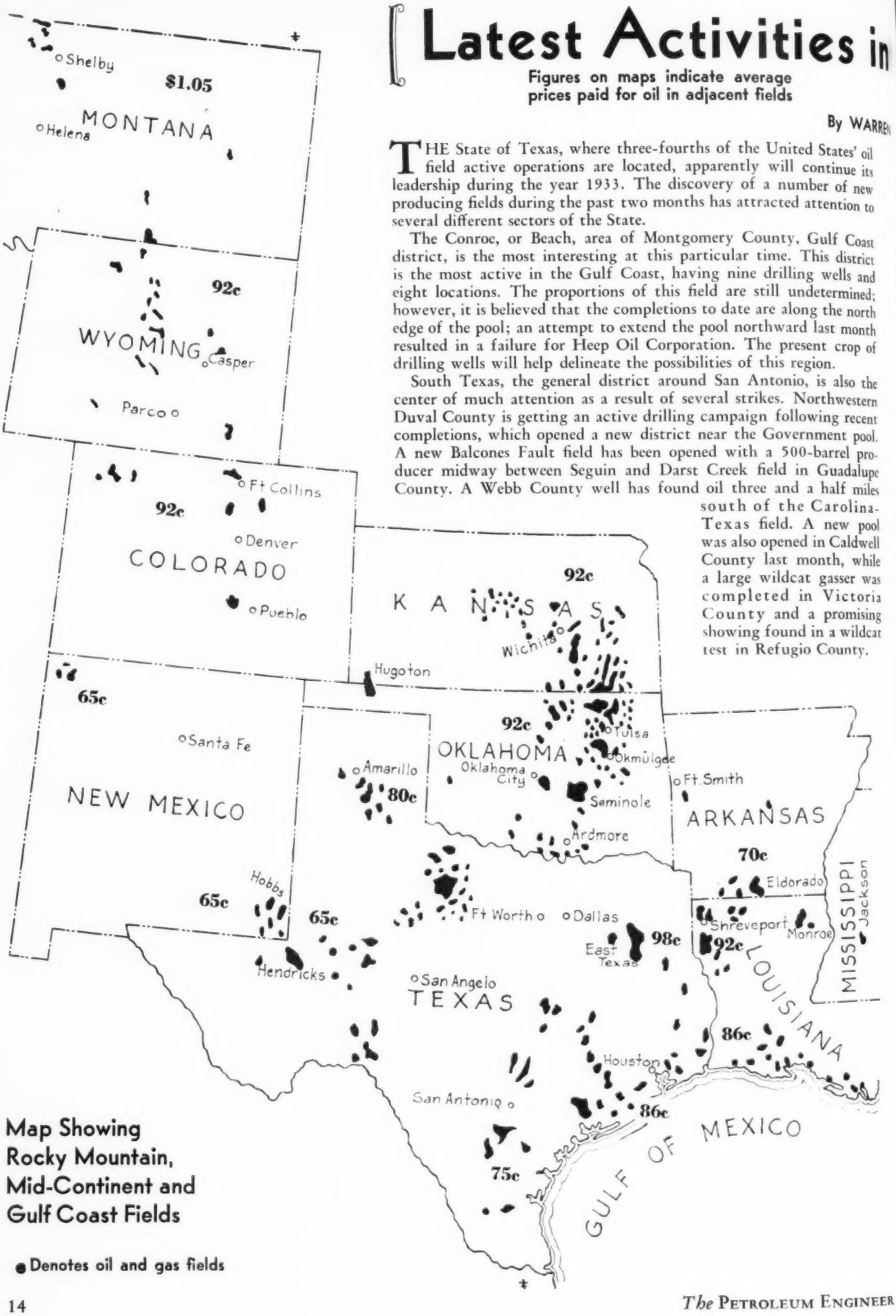
Figures on maps indicate average prices paid for oil in adjacent fields

By WARREN

THE State of Texas, where three-fourths of the United States' oil field active operations are located, apparently will continue its leadership during the year 1933. The discovery of a number of new producing fields during the past two months has attracted attention to several different sectors of the State.

The Conroe, or Beach, area of Montgomery County, Gulf Coast district, is the most interesting at this particular time. This district is the most active in the Gulf Coast, having nine drilling wells and eight locations. The proportions of this field are still undetermined; however, it is believed that the completions to date are along the north edge of the pool; an attempt to extend the pool northward last month resulted in a failure for Heep Oil Corporation. The present crop of drilling wells will help delineate the possibilities of this region.

South Texas, the general district around San Antonio, is also the center of much attention as a result of several strikes. Northwestern Duval County is getting an active drilling campaign following recent completions, which opened a new district near the Government pool. A new Balcones Fault field has been opened with a 500-barrel producer midway between Seguin and Darst Creek field in Guadalupe County. A Webb County well has found oil three and a half miles south of the Carolina-Texas field. A new pool was also opened in Caldwell County last month, while a large wildcat gasser was completed in Victoria County and a promising showing found in a wildcat test in Refugio County.



Map Showing Rocky Mountain, Mid-Continent and Gulf Coast Fields

● Denotes oil and gas fields

the Oil Fields

Figures giving production of individual fields will be found on page 9

L. BAKER

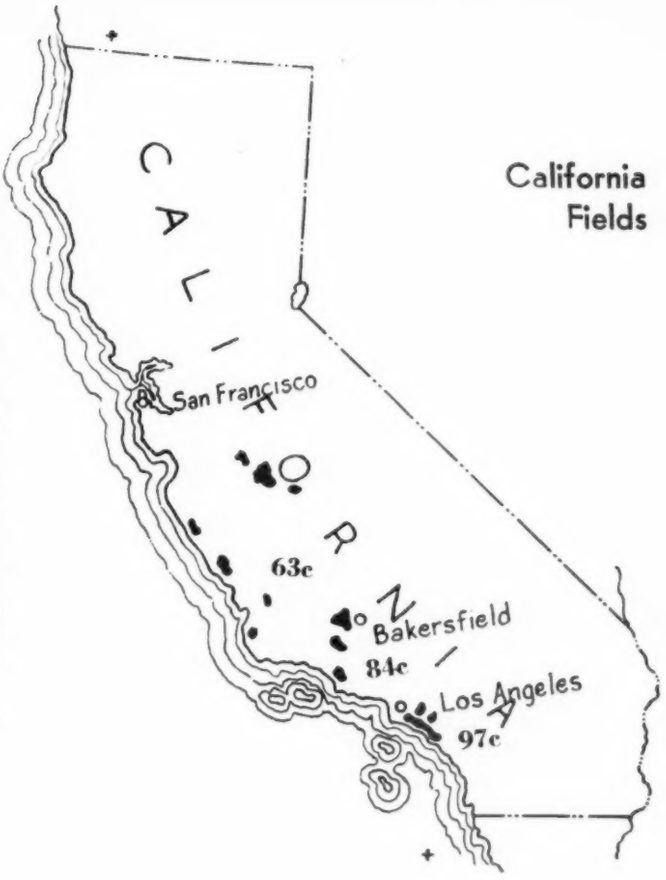
East Texas field operations continue to approximate the present rate of development, with many of the principal operating companies planning to push work during the summer months and then let up this winter. This has caused activity to steadily gain during the last few months.

Water encroachment in the field continues to increase, but is not expected to develop rapidly for some time. The rush to complete wells and faulty measurements have been responsible for drilling a number of wells into salt water. Eighty-one wells are now listed on water reports. Salt water encroachment made its appearance in the very heart of the Joiner area last month, when one well started making 4 per cent water. When the well was plugged back, the water trouble ceased.

The principal developments in California fields have been at Kettleman Hills, where indications are that the Middle Dome area may not be as important a producing factor as anticipated, as Standard's test has encountered considerable water. The North Dome region also appears to have been limited by disappointing wells.

Recent results in the Ellsworth Arch area of Kansas indicate that the region will be spotted and practically every test is a wildcat regardless of its location. Thirty-six producers in this territory are estimated to have a potential of over 40,000 barrels daily.

Ten miles southwest of Pawhuska, Osage County, Oklahoma, a 70-barrel an hour well in the Siliceous lime may start a deepening campaign in this locality.



California Fields

East Central and Eastern Fields

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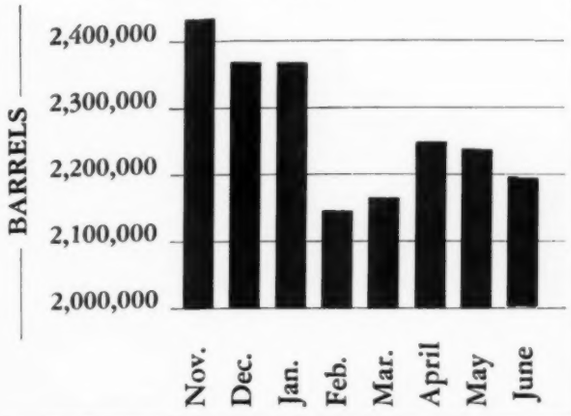
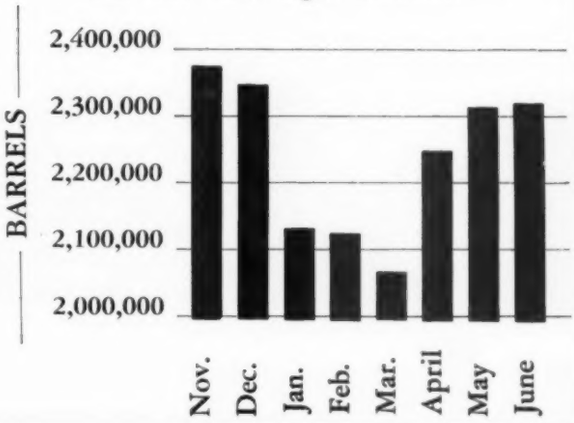
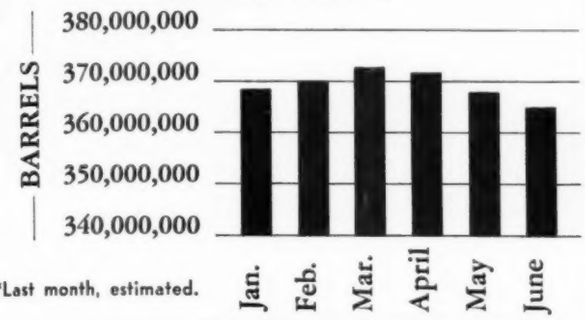
U. S. Daily Average Production for the Past Eight Months



Daily Average Crude Run to Stills for the Past Eight Months

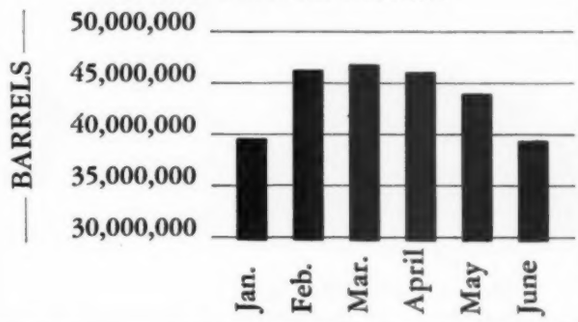


U. S. Crude Oil Stocks for the Past Six Months*



*Last month, estimated.

Gasoline Stocks in U. S. Refineries for the Past Six Months



Summarized Operations in Active Fields for June, 1932

Fields	Completions	Producers	Locations	Rigs	Drilling Wells	Depth of Production	Gravity of Oil	Type of Tool Used
TEXAS								
East Texas	838	829	821	261	375	3600	40	Rotary
Van	9	8	8	2	10	2600	36	Rotary
Panhandle	15	14	12	10	37	2900	40	Rotary
OKLAHOMA								
Oklahoma City	19	16	6	4	61	6500	39	Rotary
KANSAS								
McPherson	10	8	20	12	43	2900-3400	38	Rot.-Cab.
Ellsworth Arch	8	7	13	7	25	3300	37	Cable
Sedgwich	8	5	2	2	8	2900-3500	39	Rot.-Cab.
CALIFORNIA								
Kettleman Hills	1	1	1	1	14	8300	60	Rotary
Long Beach	3	3	0	0	7	7000	26	Rotary
Ventura	2	1	0	1	6	7800	36	Rotary

Field Activities by States for June, 1932

State	Completions	Producers	Locations	Rigs	Drilling Wells	Production, 1931 (in Barrels)
Arkansas	9	0	1	5	22	15,425,000
California	24	17	22	19	141	188,575,000
Colorado	5	1	1	9	63	1,510,000
Illinois	2	2	....	1	19	4,850,000
Indiana	20	11	....	4	59	830,000
Kansas	51	34	83	50	125	37,950,000
Kentucky	49	30	....	9	69	6,490,000
Louisiana	53	23	59	39	89	22,325,000
Michigan	13	4	....	41	75	3,730,000
Mississippi	6	3	4	2	14	Gas Prod.
Montana	1	1	5	15	51	2,855,000
New Mexico	4	4	....	9	46	15,250,000
New York	14	13	....	2	17	3,400,000
Ohio	67	47	....	30	109	5,315,000
Oklahoma	114	82	130	96	220	177,750,000
Pennsylvania	55	53	....	17	85	11,225,000
Tennessee	0	0	....	0	13	8,000
Texas	1163	992	1,225	471	948	330,720,000
West Virginia	28	23	....	17	38	4,480,000
Wyoming	2	1	....	14	62	14,725,000
TOTAL	1,680	1346	1,530	850	2,266	847,413,000

Progress of Major Pipe Line Work

By J. H. DAMERON

THE only new pipe line work announced during the past thirty days was a small amount of oil line work in Texas and considerable natural gas expansion work in the Northern states. Southern Counties Gas Company, Los Angeles, Calif., is making steady progress on the construction of its 12-inch line which will supply San Diego, Calif., with natural gas.

In South Texas the Humble Pipe Line Company is about 50 per cent completed with its work on a 28-mile line which will supply the new Conroe field with a crude oil outlet. The line is expected to be placed in operation during the latter part of July. One field station located adjacent to the producing area will be the only pump station operated at this time. The line connects with the Humble's main line system. Several other pipe line companies have main lines which pass reasonably close to the new Conroe field.

In the Northern states several companies are building short lateral lines to serve additional towns near their main line systems. This type of work so far has involved only a few miles of pipe for each project.

In the aggregate the lateral line construction work has amounted to a fairly large amount of pipe. Numerous other jobs of this type are in sight for this summer's completion. This is particularly true in Iowa and Nebraska. Representative of this type of work is the plan of the Iowa-Nebraska Light & Power Company to build a nine-mile lateral to Clarinda, Iowa, and the Central States Electric Company plans to build a seven-mile line to Creston, Iowa.

Several other companies in both states, as well as in other states, have similar projects under way. In addition to this the same companies, and other companies, are seeking franchises in additional towns and cities in that general area. Numerous gas companies are enlarging their city distributing systems. In Montreal, Canada, the Montreal Light, Heat & Power Company has authorized the appropriation of about a half million dollars for the expansion of its natural gas system. This will necessitate the construction of about twenty miles of gas line to be built with pipe ranging from sixteen-inch down to six-inch.

In the extreme northern states several individuals and companies are preparing to be more active in efforts to obtain franchises in small towns. In most of these instances butane plants are being built and will serve the cities until large transmission lines proposed for that area are built.

Another company has entered into the scrape among various gas transmission companies to supply gas to Detroit, Michigan. The Peninsular Pipe Line Construction Company has been incorporated in Michigan for the purpose of laying a large diameter natural gas transmission line from the Mount Pleasant, Michigan, field to Detroit. The proposed line would be about 150 miles in length. For several months other interests have been attempting to enter Detroit with a natural gas line. Several estimate that Detroit offers a potential market of above fifty million feet daily.

The many oil and gas transporting companies that started considerable reconditioning work a few weeks ago are well under way with their programs. This work will perhaps be extended over a period of two or three more months.

Missouri Light and Power Company recently finished construction of a sixteen-mile lateral line to Excelsior Springs, Missouri, to afford the resort city its first natural gas. The line was built from a nearby gas field. William Lahar Construction Company, Boonville, Missouri, had the general contract to build the combination six-inch and eight-inch welded carrier. The line is comprised of thirteen miles of six-inch and three miles of eight-inch pipe. Field pressure will be utilized for the present to deliver gas to the city gates.

In Kansas the Fredell Construction Company has finished a short welded eight-inch line for the White Eagle Oil Corporation, at Augusta. The short line was built to afford additional crude supply to the oil company's refinery located at Augusta.

No new announcements have been made concerning the construction of the Standard Oil Company, of Kansas eight-inch welded line into western Kansas. The new line is planned to give the Standard Company additional capacity for its Kansas refining operations from newer fields located in the western part of the state.

Southern Counties Gas Company Project

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PIPE LINES UNDER CONSTRUCTION AND CONTEMPLATED

Type Line	Company Name	Headquarters	Point of Origin	Terminal	Size Pipe	Length in Miles	Remarks
Ga.L.	Atlantic Refg. Co.	Philadelphia, Pa.	Point Breeze	Wilkes-Barre, Pittsburgh	6-8"	475	Part of system operating. Plan extension of main line this year.
G. L.	Bivens, C. E., et al.	Laramie, Wyo.	Baggs Field	Laramie, Wyo.	12"	104	Plan to build in 1932. Granted extension of time.
G. L.	Big Bend Pipe Line Co.	Ft. Stockton, Tex.	(See Remarks)				Plan to extend present system with 60 miles of 4-inch.
G. L.	Columbia Gas & Elec. Co.	New York, N. Y.	Ky. or Pan Eastern Line	Detroit, Mich.	20"	220	Considering going to Detroit, Mich., with line and to Toledo.
G. L.	Continental Constr. Corp.	Chicago, Ill.	Chicago, Ill.	Detroit, Mich.	20"	200	Plan extension of Panhandle line to Detroit.
G. L.	Continental Constr. Corp.	Chicago, Ill.	Point in Ill.	Wilwaukee, Wis.	20"	160	Under advisement.
G. L.	Cities Service, Insull, Texas Corp. & S. O. N. J.	(See Remarks)					Rumored considering building 1,500-mile project from Panhandle to Eastern cities.
G. L.	Golston, Roy D.	Tyler, Tex.	Brownwood, Tex.	Lampasas, Tex.			Considering building gas line.
Ga.L.	Great Lake Pipe Line Co.	Kansas City, Mo.	Okla. Midcontinent	Great Lakes Region	4-6-8"	1440	Considering increasing station capacity.
G. L.	Great Northern Gas & Utilities Co.	Minneapolis, Minn.	(See Remarks)				Planning gas line from Baker-Glendive area in Montana to Minneapolis and St. Paul.
G. L.	Hutcherson Pipe Line & Gas Co.	McPherson, Kan.	(See Remarks)				To build short line from Ritz-Canton area in McPherson County, Kan., to McPherson.
O. L.	Humble Pipe Line Co.	Houston, Texas	Conroe, Main Line		8"	28	Work half complete.
G. L.	International Util. Corp.	New York, N. Y.	Alberta, Canada	Vancouver, B. C.	20"	500	Proposed
G. L.	Kentucky Public Service Co.	(See Remarks)					Posted bond to build short line from Hart County, Ky., to Bardstown, Ky.
G. L.	Jerome Drumheller	Spokane, Wash.	Cut Bank, Wyo.	Seattle, Wash.	20"	500	Proposed.
G. L.	Lycoming Nat. Gas. Corp.	New York, N. Y.	Tioga Field, N. Y.	Syracuse, N. Y.			Plan to extend main line from Syracuse to Oswego with 38 miles of 16-inch.
G. L.	Lewiston Nat. Gas Co.	Lewiston, Mont.	Armells Structure, Mont.	Montana Towns	4-6"	100	Proposed.
G. L.	Mid-Continent Public Service Co.	Fort Scott, Kan.	Field near Chanute	Fort Scott	8"	28	Moore-Creekmore Const. Co., Tulsa, has contract to build upon completion of plans.
G. L.	Missouri Valley P. L. Co.	Omaha, Neb.	Point in Minnesota	Minneapolis, Minn.	16"		Proposed along with extension work in Iowa.
G. L.	Montana-Dakota Power Co.	Minneapolis, Minn.	Williams, N. D.	Minot, N. D.	12"	100	Applied to N. D. Commission for permission to build.
G. L.	Mo.-Kans. Pipe Line Co.	Chicago, Ill.	Russellville, Ky.	Nashville, Tenn.	10"	50	Proposed.
G. L.	North Central Gas Co.	Casper, Wyo.	(See Remarks)				Reported planning 100 miles of extension work in Nebraska and near-by territory. Part of work underway.
O. L.	Old Dutch Refining Co.	Muskegon, Mich.	East Michigan Fields	Muskegon	4"	100	Considering building.
G. L.	Ohio Oil Company	Findlay, Ohio	Weiser Field, Idaho	Boise and Northwest Area			Filed application for conveyance certificate.
G. L.	Pacific Gas & Elec. Co.	San Francisco, Calif.					Have appro. for $2,000,000 expansion campaign. Building 45 miles of 26-inch.
G. L.	Panhandle Eastern P. L. Co.	Kansas City, Mo.	(See Remarks)				Completing lateral line work.
O. L.	Presidio Petroleum Co., Ltd.	Los Angeles, Calif.	Midland, Tex.	Topolobampo	10"	640	Propose to build to Mexican Port and erect two refineries, one at Chihuahua for domestic trade and the other at tidewater for export trade. Plan to parallel oil line with gas line to Chihuahua. J. F. Sadler promoting.
G. L.	Peninsular Pipe Line Construction Co.	Detroit, Mich.	(See Remarks)				Reported planning building 160-mile line from Mt. Pleasant field in Mich. to Detroit.
O. L.	San Juan Pipe Line Co.	Los Angeles, Calif.	San Juan County, Utah	Farmington, N. M.	8"	92	Reported planning to build this summer. Line will have three stations.
	Standard Oil Co., of Kansas		(See Remarks)				Plan to build 150 miles 8-inch into western Kansas.
G. L.	Southern California Gas Co.	Los Angeles, Calif.	(See Remarks)				Building laterals to three new towns.
G. L.	Southern Counties Gas Co.	Los Angeles, Calif.	Huntington Beach	La Jolla	12"	68	To supply gas to San Diego. Construction underway.
G. L.	Southern Nat. Gas Corp.	Birmingham, Ala.	(See Remarks)				Reported planning extension to Chattanooga, Tenn.
G. L.	St. Louis Industrial Fuel Co.	St. Louis, Mo.	(See Remarks)				Plan to enter St. Louis for industrial loads with line from southwest.
G. L.	Wasatch Gas Company	Ogden, Utah	Ogden, Utah	Pocatello, Idaho	10"	140	Applied for permit to build welded line.

TABLE

O L.—oil line
G. L.—gas line
Ga. L.—gasoline line

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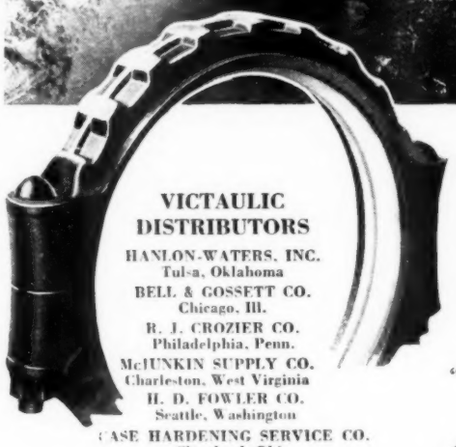

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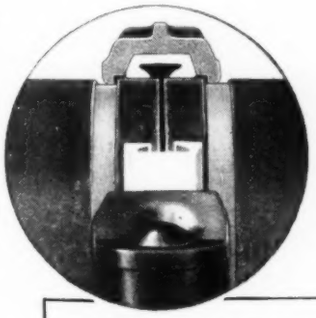

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The Month's Activities in Refining*

By F. R. STALEY

THE Foster Wheeler Corporation is building a vacuum rerun distillation unit to process treated lube oil at the Avon, California, refinery of the Union Oil Company.

The Marathon Oil Company will install new cracking units in its refineries at Fort Worth, Texas, and at Bristow, Okla.

The Sinclair Refining Company is installing a new cracking unit in its refinery at Coffeyville, Kansas.

Operations will start this month at the new refinery at Denver, Colo., built by the Midland Oil & Refining Company. The plant will run 1,000 barrels of crude daily from the Osage field in Wyoming.

The Shell Oil Company of Canada, Ltd., will construct a modern refinery at East Montreal, Canada.

The Radio Oil Refineries Limited, Winnipeg, Canada, is planning to install a cracking plant.

Arthur G. McKee & Company is building a Dubbs unit designed to crack 3,000 barrels a day of straight run gasoline in the refinery of the Pennzoil Company, Oil City, Pa.

The Inland Oil & Gas Company, Abilene, Texas, is planning to build a cracking plant near Abilene, Texas.

The Mentone Oil and Refining Company, Mentone, Texas, is building a 1,000 barrel per day refinery at Mentone, Texas.

The Standard Oil Company of Indiana will supply the highway department of Colorado with two million gallons of road oil to surface 55 miles of highway.

According to the U. S. Bureau of Mines figures, the output of emulsified asphalt in the United States increased from 27,211,169 gallons in 1930 to 36,848,875 gallons in 1931.

Effective July first the Ethyl Gasoline Corporation adopted the five-day week. This applies to the employees in the entire organization, but will not affect the business hours of the company.

At the annual meeting of the A. S. T. M. in Atlantic City, Committee D-2 endorsed the C. F. R. engine for measuring octane numbers of motor fuels. Procedure conditions, such as engine speed and operating temperature, are being studied by the Detonation Subcommittee in conjunction with road tests. It is expected that in the near future these results will permit establishment of an A. S. T. M. tentative method of test.

The California Natural Gasoline Association nominated the following officers for the year 1932-33: R. C. Wheeler, General Petroleum Corporation, for president; N. H. Mull, The Texas Company, for vice-president; and Wallace McIlhany for secretary.

A 500-barrel plant is being built at Pilot Point, Texas, to produce road oils from crude produced in the Jacob field. J. C. Schrouder and Bruce Young are the operators.

NATURAL GASOLINE

The U. S. Bureau of Mines reports the world production of natural gasoline totaled 49,877,000 barrels during 1931, a decrease of 15.6 per cent from the record total of 59,111,000 barrels reported for 1930. The output of natural gasoline plants in the United States declined 18.4 per cent, while the production in foreign countries increased 6.6 per cent.

The output of natural gasoline was reported in 18 countries. Reports of the erection of a plant in Germany and one in Italy indicate that the list of producing countries will be extended to 20 during the year. The plant of the Peppers Gasoline Company in the Oklahoma City field recently started operating. It has a rated capacity of 30,000,000 cubic feet per day.

Refineries in the Eastern and in the Western division increased their crude runs over the previous month.

Figures in red show per cent refining capacity operated.

*All statistics as of July 1.

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9130-Foot String of Casing Set and Cemented Under High Bottom-Hole Temperature

By K. C. SCLATER

RECENTLY the deepest cementing job ever undertaken on a well in the Gulf Coast was successfully carried out when a string of 5¾-inch casing was set and cemented at a depth of 9,130 feet. The success of this job is all the more remarkable when it is learned that the bottom-hole temperature in this particular well is estimated to be at least 285 degrees Fahrenheit. Further, the well is in the Refugio field, Refugio County, Texas, a locality that burdens the operator with hazards that add to the ordinary difficulties encountered in deep well drilling operations.

Aside from being the deepest cementing job completed to date in the Gulf Coast fields, it also has the distinction of having been completed with a full-size screen in the producing sand.

Originally drilled to a depth of approximately 5,450 feet, from which depth it had been producing, the well was deepened to its present total depth of 9,131 feet. It is the Edwin M. Jones well, Mitchell B-1, three-quarters of a mile south of the town of Refugio.

The total length of the string that was run is 9,130 feet and, except for the lower 110 feet, which is six-inch wide-wrapped screen pipe, consists of 5¾-inch A.P.I. 23-pound special external upset casing. The inner surface of the screen was lined with Howco lining to assure the thorough washing of the heavy mud and cuttings from behind the screen and off the face of the producing sand. This Howco lining is one of the latest advancements in oil well cementing practice and has already proved to be a successful innovation, and a far-reaching contribution to the art of well cementing.

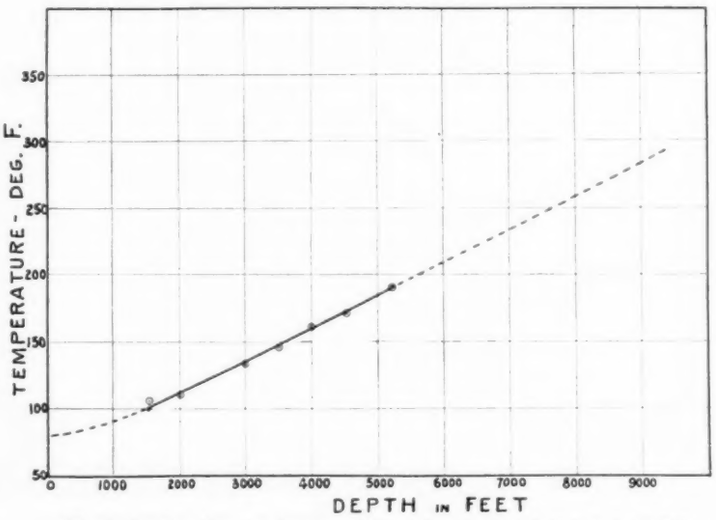


Chart showing temperature readings taken in Mitchell B-1 to 5,200 feet with Halliburton temperature bomb containing three maximum reading thermometers

A heavy steel shoe was placed on the bottom of the screen. Immediately above the screen a float collar and a full hole cementer was inserted.

Preparatory to running and cementing the casing temperature readings were taken in the well down to a depth of 5,200 feet. These were obtained by means of three maximum reading thermometers inside a Halliburton temperature bomb. The series of readings obtained were plotted as shown on the accompanying graph. By extra polation of the curve plotted from actual readings it is estimated that a temperature of at least 285 degrees F. prevails at 9,100 feet.

To combat the high bottom-hole temperature and prevent harmful interference with the setting of the cement, 35 tons of ice were used to lower the temperature of the water with which the cement was subsequently mixed.

With a recorded temperature of 185 degrees F. at 5,200 feet, speed in placing the cement was paramount in order for the job to be successful. In all, 250 sacks of slow-setting cement was pumped down inside, then out through the full hole cementer and behind the casing. It took only 49 minutes from the time the first sack of cement was mixed until all the cement was in place in the well; but only 22 minutes were consumed from the time the first of the cement was started down the casing until it was all in place. The remarkable speed with which this operation was facilitated must be seen to be appreciated. According to these figures the probable average rate of travel of the cement in the casing was ten feet per second.

Excellent time was also made in running the string of casing, the total weight of which was approximately 210,000 pounds. Before starting to deepen the well, the casing already in the hole was not disturbed. It was cased with 12½-inch casing at the surface and an inner string of 9⅝-inch casing. An 8¾-inch open hole was drilled from 5,450 feet, the bottom of the 9⅝-inch, and carried to the present total depth of 9,131 feet. It took only 15 hours and 15 minutes to run the string of casing. Much of the success and smoothness with which the string of casing was floated in was due to the prime condition of the mud.

Before running the casing the mud was carefully tested and conditioned. Though on test the circulating mud had a weight of 10½ pounds per gallon it also showed a high viscosity. This condition was rectified by proper treatment with colloidal compounds and weighting material. The weight was increased to 11¾ pounds per gallon and the viscosity reduced. During the entire job the condition of the mud was under careful observation. Its importance in a case of this kind, running a long string of casing in some 3,500 feet of open hole to a depth of 9,100 feet, cannot be overemphasized.

Mud circulation was started when about 5,300 feet of casing was in the hole. It required a pressure of about 700 pounds to establish circulation. When circulation was well established the pump pressure dropped to 500 pounds.

Temperatures were taken of the circulating mud just before cementing and it was found to run from 90 to 95 degrees F. at the pump. Just before the cement set the temperature of the circulating mud was 120 degrees F.

Much of the credit for the satisfactory outcome of this job goes to Edwin M. Jones himself, the owner of the well. He worked assiduously to the end that every possible detail in

connection with the job was properly covered and cared for. No detail was overlooked that might interfere with or mar the successful completion of the well.

Some consideration had even been given to cementing the casing, using the Multiple Stage cementing process so as to decrease the hazard incident to high bottom-hole temperature. On account of the inherent difficulties of cementing at this depth it was reluctantly decided to forego the benefits of Multiple Stage cementing and to use only the Full Hole cementer. It was a great source of gratification to everyone concerned that the job was successfully completed without a hitch.

Expert handling of the casing while it was being run is

Edwin M. Jones Well, Mitchell B-1, in the Refugio field, Refugio County, Texas, in which a 9,100-foot string of 5¾-inch 23-pound external upset casing was set and cemented under high bottom hole temperature.

accounted for by the fact that it was done by the efficient drilling crews on the well, the personnel of which was composed of Bill Lynd, driller on day tour, and his crew, Monroe Dillon, Raymond Cook, J. H. Skidmore, Leon Holland and Jim Wilkins, and George Smith, driller on night tour, and his crew, M. A. Harvey, L. K. Vernon, H. E. Baylis and John Surber.

Casing hit bottom almost exactly to the foot, a fine piece of work, the credit for which goes to the two men responsible for the pipe tallies, Joseph M. White and G. Roy Anderson, of Mr. Jones' staff in San Antonio.

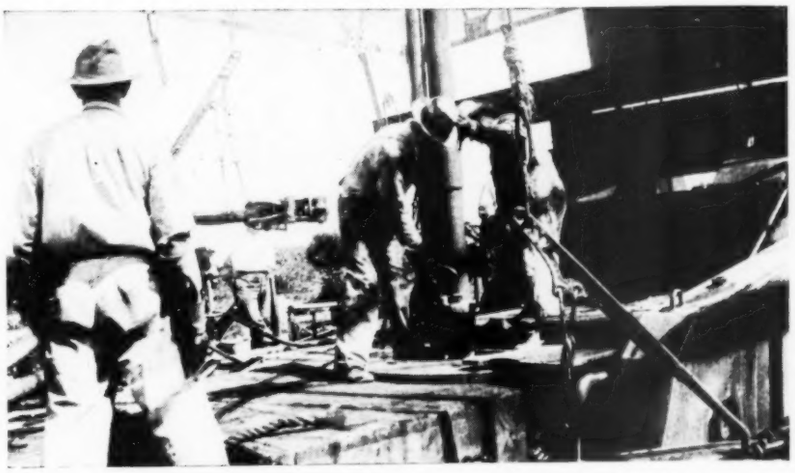
All the cementing work was done under the supervision of W. R. McClendon, superintendent of the Gulf Coast division for Halliburton Oil Well Cementing Company, with the coöperation of C. P. Parsons, field engineer. The cementers, who displayed remarkable teamwork and speed, were Sandy Brockman, C. C. Hearn and L. B. Meaders.

It is of interest to note the important items of equipment on this well that contributed in large measure to the success of the job and a freedom from trouble that was conspicuous.

A set of "B-J" 10¾-inch O. D. slip-ring type elevators with wide door casing elevators with 5¾-inch O. D. slips were used. These slips, special Mission, were used to suspend the casing through the entire job. The elevators had 2¾-inch by 108-inch weldless "B-J" links. The rotary hook used was a "B-J" triplex with a safe working load of 300 tons. Other items of equipment were: An Oil Well rotary draw works; 15-inch by 7¾-inch by 20-inch Oil Well mud pumps with Mission valves; Union Tool rotary table, traveling block and crown block.

Another interesting feature was observed in completing this well. A special string of 2½-inch, 6½-pound external upset tubing was run in the well after cementing, the lower end of which was equipped with special long couplings and a diamond point drilling bit. The purpose of equipping the lower end of the tubing with heavy couplings is to facilitate drilling out the float plug and the Howco cement lining on the inside face of the screen pipe. By this method it is not necessary to run a string of drill pipe. On a deep hole such as this it represents quite a saving in both time and labor. This method has been singularly successful in the East Texas field in the completion of wells. As soon as the plug and cement lining are drilled out the well can be placed on production immediately. Also the fact that the well is finished with a full-size screen the diameter of which need not be any less than the greatest diameter of the casing string gives a larger superficial screen area. It also permits of taking full advantage of a large diameter hole in the sand. In this deep well with a small diameter casing string it will be an effective factor in increasing the potential production possibilities by virtue of the increased superficial area of producing sand exposed in the hole. In deep wells of relatively small diameter this is an extremely vital factor.

It can be said that the success that has attended the completion of this well is significant as pointing to the progress that has been made in oil well cementing practice. Deep well problems are being solved as difficulties arise and there is no need to anticipate that depth will be a serious deterrent to the safe and successful completion of wells, at least so far as the secure cementing of the casing in the well is concerned.



Running the 9,100-foot string of 5¾-inch 23-pound external upset casing in the Edwin M. Jones well, Mitchell B-1, in the Refugio field, Texas

Analysis of the New Conroe Field Crude Oil

THERE is considerable interest in the grade of crude oil produced in the Conroe field, central Montgomery County, Texas. More than the usual attention is being given to the development of this field because of the fact that it lies right in the path of trunk lines carrying oil from the East Texas field to the Gulf Coast.

At the present writing four wells have been completed in the field, and two of these can only be classed as oil wells, as the other two produce mostly gas. Information on underground structural conditions is still meager and it may be that the upper part of the producing horizon from which these wells are producing may contain large volumes of gas and only the lighter components of the oil. With greater penetration it may be that crude will be produced that will more closely typify the average grade of crude that subsequently will be produced from the field.

An analysis of the crude produced by the Heep Oil Corporation's J. R. Freeman No. 1, the most easterly well completed in the field when the sample was taken, is here given. It will be seen that it is a sweet mixed base crude and resembles more a Mid-Continent crude than a Gulf Coast crude.

Its similarity to East Texas crude also makes it of more than ordinary interest to refiners because of the closer proximity of the field to Gulf Coast refining centers and to deep water transportation.

In regard to drilling it is significant that the Railroad Commission has for the first time included a clause limiting the maximum deviation from the vertical in wells. An oil and gas conservation order governing field production states that deviation from the vertical shall be not more than five degrees when spacing between wells is twenty or more acres; four per cent on tracts of ten to twenty acres and three per cent in wells in tracts on ten acres or less. Never before has such a clause been embodied in a Texas proration order.

Analysis of a Sample of Crude Oil from the Conroe Field, Montgomery County, Texas

CRUDE:

Gravity	38.0 A P I
Viscosity, Saybolt	32 sec. at 100 deg. F.
	30 sec. at 130 deg. F.
Pour	30 deg. F.
Paraffine	3.5%
Sulphur	0.10%

YIELDS:

Gasoline	39.2% of crude
Gas Oil	25.0% of crude
Bottoms	35.1% of crude

GASOLINE CUT:

Gravity	49.2 A P I
10%	210 deg. F.
50%	286
90%	382
End point	426
Recovery	98.0%
Sulphur	.02%

GAS OIL CUT:

Gravity	34.9 A P I
Initial	428 deg. F.
10%	448
50%	474
90%	518
End point	548
Recovery	98.0%
Sulphur	.05%
Fire	225 deg. F.

BOTTOMS:

Gravity	28.5 A P I
Flash	315 deg. F.
Fire	345
Viscosity, Saybolt	81 sec. at 100 deg. F.
	38 sec. at 210 deg. F.
Sulphur	0.17%
Pourtest	75 deg. F.

This is a sweet mixed-base crude.

THIS MONTH'S COVER

The scene reproduced on our front cover this month is an artist's conception of an oil field boom.

Soon after the discovery of any important producing area, thousands of persons flock to the district. They come in rattle-trap cars, in covered wagons and many on foot; and all plan on eking out a living by working in the fields or by starting rooming and eating places. Tents and houses, no more than shacks made of rough timber loosely thrown together, spring up everywhere like mushrooms.

Likewise, small machine shops take form where yesterday there was only a barren field. The hustle and bustle of this building campaign presents a vivid picture of activity, which will continue during the development stage of the field, after which much of the population will begin to look for greener pastures, and soon the town, like the oil field, will decline to the normal stage of "settled production."

New oil strikes are generally discovered in "out-of-the-way" localities, where roads are poor, and soon the heavy traffic causes them to become practically inaccessible. In spite of these handicaps, heavy machinery must be hastily transported to the many locations. Trucks, tractors, teams and every moving device are called upon for this work.

Operating Details of East Texas Water Supply Pipe Line

By J. H. DAMERON

General View of Lamond Station, showing suction line pier

IN most of the major producing areas of the nation the problem of supplying drilling wells with water has always been a difficult factor during development. East Texas is not an exception to this condition and perhaps the largest system in the field grew out of a plan to supply leases in the north end with water for development purposes. At one time in the early history of the field a barrel of water was worth more than a barrel of East Texas crude.

Early last year the Lucey Petroleum Company built a short pipe line from Lake Harris to its leases in the Lathrop area. At the time a few other near-by lease holders agreed to purchase a small portion of the line's capacity, which to an extent, cut down the cost of the system. Since that time the system has been expanded to where it includes seventy miles of main line ranging from eight-inch pipe on down to three-inch, plus the additional mileage of lateral lines.

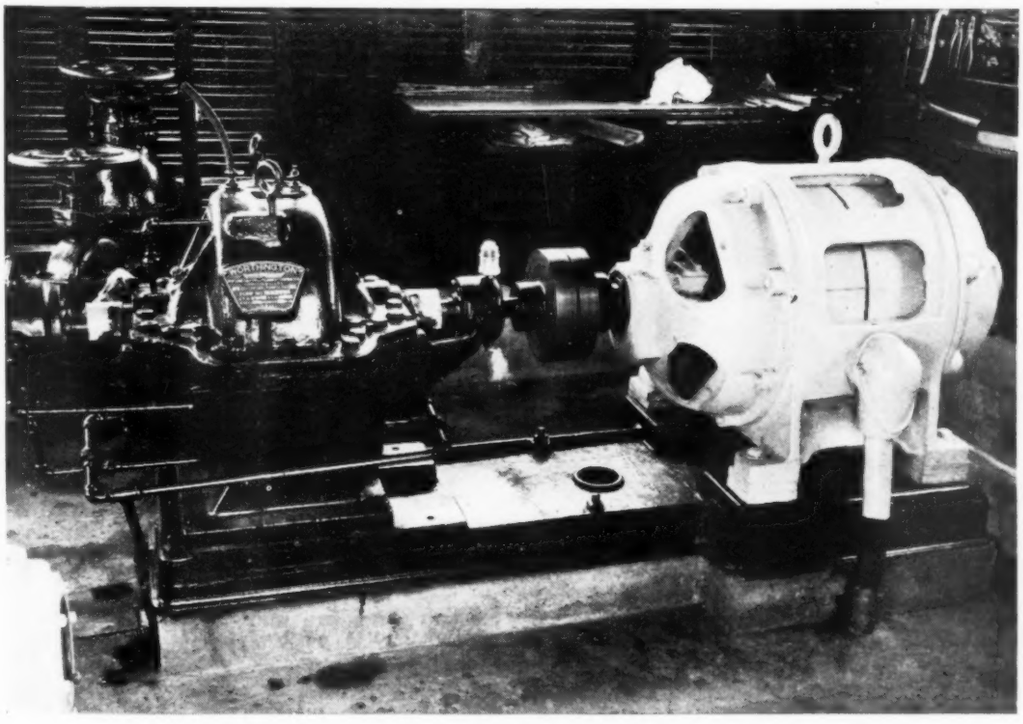
Several companies operate water systems in the East Texas area and the average cost of water in East Texas ranges somewhere between $300 and $350 per completed well. Lucey Company engineers estimate the average water consumption per drilling well is about 2,000 barrels per day. Their figures indicate the light rotaries require about 1,600 barrels daily and the heavy rotaries consume about 2,400 barrels daily.

The pipe line system is built entirely with screw pipe. Virtually all of the main line is buried and only the lateral connections running to various leases are laid above ground. None of the pipe was coated to protect it against corrosion because its period of service is indefinite.

In the construction of the main line the connection crews followed a practice of installing a tee connection every 700 feet and screwing a bull plug in the open end of the tee connection. By following this practice the connection crews are enabled to connect a lateral line to a lease with the least delay and expense.

The line is equipped with gate valves which permit cutting out small sections whenever it is desired to make a connection to the main line. All lateral lines running to the leases are built with 2½-inch screw pipe and a gate valve is installed on the lateral near the swage nipple connecting the lateral line with the main line tee connection.

Water for the system is obtained from Lake Harris and Lake Lamond, both of which are located between Longview and Gladewater. Each of the stations located on the shores of the lakes pump north and northwest, respectively, and a



Close-up View of Motor-driven Two-stage Water Pumping Unit

booster station is located in the field where the two lines converge.

The Lake Lamond station is equipped with two four-inch two-stage centrifugal pumps connected in series. The motors driving the pumps are 100-horsepower, 440-volt, three-phase, 60-cycle, induction motors with a rated full load speed of 1,750 r.p.m. Each motor is directly connected with a flexible coulping to a four-inch two-stage centrifugal pump designed to deliver 750 gallons per minute against a head of 350 feet.

Number 1 unit takes its suction direct from the lake and discharges it to the suction of number 2 unit at about 175 pounds pressure. Number 2 unit is operated to discharge against about 375 pounds pressure.

The pressure gauge on number 2 unit is equipped with an electrical contact to cause an alarm to be sounded in the event a predetermined high or low pressure is reached. The contact is set between the gauge face and gauge glass in such a position that the arrow end of the gauge needle will close the electric contact when pressure drops to 100 pounds or the other end of the needle will perform the same service when the pressure reaches 390 pounds.

Although operated in series, the piping layout permits either pumping unit to be operated singly in the event the other is down for any reason. To care for any expansion and contraction of lines as well as vibration, sleeve type and rubber ring type couplings have been installed on the discharge lines of each unit.

The suction line at Lamond extends out over the lake about forty feet on a narrow timber pier. The depth of the water at the end of the pier is about nine and one-half feet and the eight-inch suction line extends down to within eighteen inches of bottom. The end of the suction line is equipped with a strainer to prevent large objects getting into the line and possibly being carried on into the pumps.

Station equipment is housed in a sheet metal building attached to a wood frame. All of the equipment is kept neatly painted. Station equipment at Lake Harris is identical to that at Lamond.

The booster station is equipped with one two-stage four-inch pump directly connected by means of a flexible coupling to a 100-horsepower induction motor. This unit boosts the pressure to about 425 pounds.

Combined pumping capacity of the two stations located on the lakes is about 60,000 barrels daily. Lease connections to the system range from forty to sixty connections. Although when the system has its maximum connection of sixty wells there has always been plenty of pressure available in the water lines for the wells.

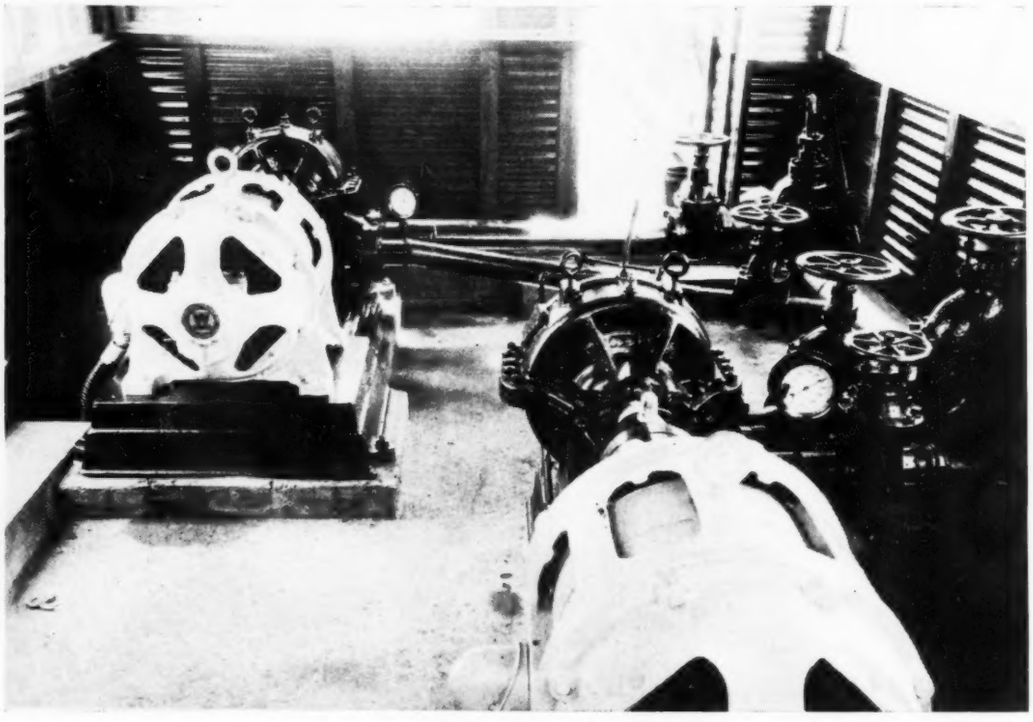
This is explained by the fact that only 40 to 50 per cent of the connected drilling rigs are pulling on the water system at any one time. The remainder are usually shut down for any one of several reasons. Because of this condition the pipe line connection crews will make connections to a point about double the station pumping capacity of the water system.

In most instances a flat per well charge is made for each connection. In some instances the water is delivered on a per day basis. Where the connection is made on a per well basis the contractor is protected on water against long fishing jobs or other delays. In several instances the connections to some rigs have remained as long as five months, due to repeated delays occasioned by fishing jobs and breakdowns.

Thus far no trouble has been experienced due to lack of pressure and only a minimum of power failures have caused the shut down of the pump stations. In the latter instance these occurred during storms of such a severe nature that all the connected wells had been shut down because of rapidly rising flood water. In many instances it has been found the drilling crews relied upon line pressure to feed boiler water to the boilers.

By having a flat rate per well the company operating the system eliminates the necessity of bookkeeping, making daily reports, accounting and billing.

In the operation of the system the producing company employs several line walkers who cover the entire line twice daily. The connection crews are usually busy each day of the month, making new connections, disconnecting lines to rigs, and moving the two and one-half-inch pipe from one lease to another.



General Interior View of Lamond Pump Station

The Manufacture of Special Products from Petroleum

By F. R. STALEY

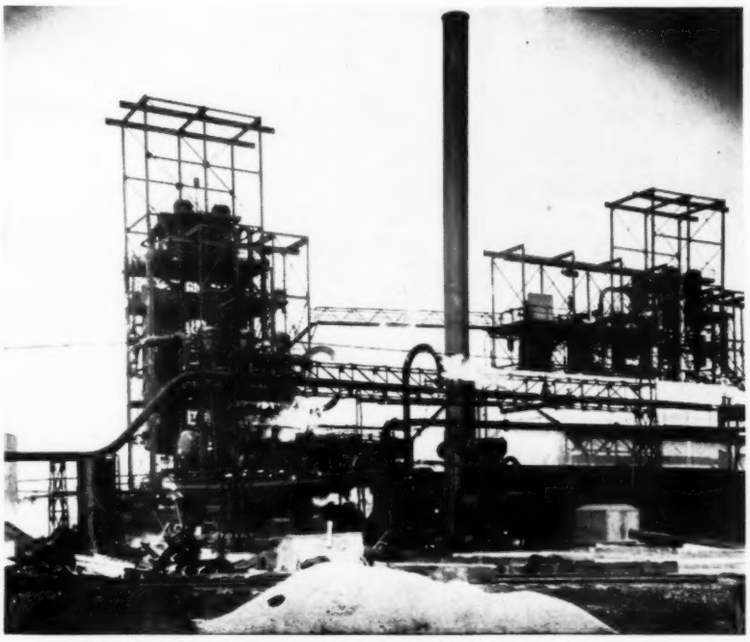
RESEARCH chemists and engineers are constantly developing new and higher quality products from petroleum, which has become an important source of raw material for numerous commercial and industrial products, including solvents, alcohols, insecticides, denaturants, cosmetics, and many more. A number of oil refining companies are operating subsidiaries which manufacture and market these preparations, thus supplying outlets for refined petroleum and refinery by-products.

Petroleum refining has become closely allied with the chemical industries. A number of plants have been built to utilize refinery gases or acid sludge as a raw material. With the large increase in cracking capacities the number of these plants will be increased.

Oberfell and Guyer[1] point out that due to existing economic conditions it has been necessary to consider the most promising markets for petroleum gases. The following possibilities are outlined:

1. Direct utilization of liquefied petroleum gases, by which they are used without further processing in the gas - manufacturing, industrial-gas and domestic-gas fields.

2. Motor fuel markets and gas industry outlets.



Cracking Units in Standard Oil Co. (Ohio) Cleveland Refinery

3. Use of gas-reforming processes by the gas industries.

4. Markets in the chemical industries.

The authors state that large quantities of relatively pure hydrocarbons of the paraffin series have been made available through efficient fractionating equipment. Extensive use of cracking processes and other methods of producing unsaturated and aromatic hydrocarbons have increased the supply of raw materials. The demand for special petroleum products by the chemical industry will affect individual companies more than the industry as a whole.

The Standard Oil Company of California has recently purchased an interest in the California Spray Chemical Company, which is one of the world's largest manufacturers of agricultural sprays. This company has made many improvements in spray chemicals, and has promoted the use of petroleum oil sprays, which are regarded as one of the best of the many insecticides which have been developed.

In the development of insecticide it was not only necessary to destroy the insect, but the product must not injure the plant nor the soil. A knowledge of plants and bugs as well as chemistry is required. Two principal type of petroleum oil sprays are used, one type during the summer and another during the winter when the pests are dormant. Petroleum oil sprays manufactured in California are exported and used over the entire world.

Last year the Shell Chemical Company completed a plant in California to manufacture ammonia by the Mont Cenis process. Hydrogen for the process is prepared from natural gas. Nitrogen is produced from the air by the Linde process. The plant produces liquid or aqua ammonia, and ammonium sulphate. The plant consists of two units each having a capacity of 30 tons of fixed nitrogen daily.

Pentane produced from natural gasoline is used as a raw material by the Sharples Solvents Corporation at Belle, W. Va., to prepare amyl chloride, amyl alcohols, and the corresponding acetates. Clark[2] outlines the chemical reaction involved in the production of the primary products:

$$C_5H_{12} + Cl_2 = C_5H_{11}Cl + HCl$$

$$C_5H_{11}Cl + NaOH = C_5H_{11}OH + NaCl$$

$$C_5H_{11}OH + CH_3CO_2H = CH_3CO_2C_5H_{11} + H_2O$$

Frolich and Wiezevich[3] classify the more important reactions which natural gas hydrocarbons undergo as follows:

(1) Cracking

(2) Oxidation

(3) Halogenation

The unsaturated hydrocarbons (refinery gases) are much more reactive, and are in addition, subject to:

(4) Addition

(5) Polymerzation

Park[4] outlines the chemical solvents produced from petroleum hydrocarbons as follows:

(1) Alcohol Groups: Synthetic amyl alcohol containing five of the eight amyl alcohols, prepared from n-pentane and isopentane by treatment with chlorine; ethanol and the secondary alcohols from isopropanol up to secondary hexanol are formed by absorption of olefines with sulphuric acid.

(2) Ether Group: Ethyl and isopropyl ethers are formed in conjunction with the preparation of alcohols; ethers of

[1]American Petroleum Institute, June, 1932.
[2]Chem. & Met. Eng., April, 1931.
[3]Ind. & Eng. Chemistry, Jan., 1932.
[4]Journal Soc. Chem. Ind., 1931 620-622.

ethylene glycol are prepared by treating an alcohol with ethylene oxide esters are produced by the action of a fatty acid and an alcohol, with vapour phase esterification or, by treatment of alkyl sulphuric ester with the calcium salt of a fatty acid. Chloro-compounds such as ethylene dichloride, are widely used as extraction solvents.

The majority of industrial solvents now produced from petroleum hpdrocarbons are utilized by the nitro-cellulose available at present. Amongst other new developments[5] pertaining to the use of industrial solvents from petroleum is the extraction of acetic acid from pyroligneous acid by means of ethyl or isoproply ether, 98-99% recovery being claimed. Isoproply ether, a new industrial solvent, compared with ethyl ether, has a lower vapor pressure, higher boiling point, higher flash point, is not so soluble in water, and possesses somewhat higher solvent powers.

One large corporation[6] has developed a number of formulae for the preparation of emulsions and other products with triethanolamine. Many of these preparations contain refined oils and naphtha. Triethanolamine is a synthetic chemical which in the last few years has been produced commercially. It is well adapted to the preparation of technical emulsion.

Some of the formulae published by this company are as follows:

Automobile Polish

Carnauba Wax	9 lbs.	Stearic Acid	7 lbs.
Beeswax	4 lbs.	Triethanolamine	2.5 lbs.
Ceresin Wax	4 lbs.	Water	75 lbs.
Naphtha	75 lbs.	Abrasive	25 to 68 lbs.

Add the triethanolamine and stearic acid to the water, heat to 100 degrees C. and stir to obtain a smooth soap solution. Then melt the waxes in the naphtha and, when the solution is about 85 degrees to 90 degrees C. add it to the hot soap solution. Stir vigorously until a smooth emulsion is obtained and then slowly until cold. If any separation occurs shortly after the emulsion has cooled, stir vigorously until the emulsion is creamy.

Liquid Furniture Polish

Carnauba Wax	6 lbs.	Turpentine	4 lbs.
Paraffin Wax	9 lbs.	Stearic Acid	4 lbs.
Ceresin Wax	2 lbs.	Triethanolamine	1.5 lbs.
Naphtha	43 lbs.	Water	130 lbs.

Add the triethanolamine and stearic acid to the water, heat to boiling and stir to obtain a smooth soap solution. In a separate container melt the wax in the solvent, heat to 85 degrees to 90 degrees C. and then add this solution to the soap solution. Stir vigorously until a smooth emulsion is obtained. In the case of the wax paste, continue stirring until the emulsion is partially cooled but still thin enough to pour into containers. In making the liquid polish, continue stirring slowly until the emulsion is cold.

Soluble Cutting Oil

Mineral Oil	88 lbs.	Triethanolamine	3.7 lbs.
Oleic Acid	8.0 lbs.		

Formulation by this method requires great exactness, and it is always necessary to derive formulae for the specific oil to be emulsified because of the great variation in commercial petroleum products. The emulsifying action is brought about by dissolving a soap or similar compound in the oil. Triethanolamine is an ideal constituent of soluble mineral oils. It is practically soluble in all mineral oils and seldom requires more than one per cent excess fatty acid to hold it in solution.

Cutting Oil

Mineral Oil	88 lbs.	Triethanolamine	3.7 lbs.
Oleic Acid	8.0 lbs.	Water	

The above formulae was derived for a particularly low viscosity lubricating oil and is typical of the formulation for a cutting oil.

Orchard Sprays

Mineral Oil	87 lbs.	Triethanolamine	3.5 lbs.
Oleic Acid	8.8 lbs.	Water	

The above formula was derived for an oil suitable for an orchard spray.

Metal Polish

Naphtha	62 lbs.	Triethanolamine	0.33 lb.
Oleic Acid	1 lb.	Ammonia (26 Deg.)	1 lb.
Abrasive	7 lbs.	Water	128 lbs.

In one container mix together the naphtha and oleic acid to a clear solution. Dissolve the triethanolamine in the water separately, stir in the abrasive, if it is of clay type, and then add the naphtha solution. Stir the resulting mixture at a high speed until a uniform creamy emulsion results. Then add the ammonia and mix well, but do not agitate as vigorously as before.

Cosmetics, Cold Cream

Stearic Acid	30 lbs.	Mineral Oil	33 lbs.
Lanolin	6 lbs.	Triethanolamine	3.8 lbs.
Beeswax	16 lbs.	Carbitol	16 lbs.
	Water	95 lbs.	

Melt the stearic acid, lanolin and beeswax in the mineral oil and heat to about 70 degrees C. Prepare in a separate kettle a boiling solution of the triethanolamine and water, and add to this the hot solution of waxes. Stir vigorously.

Shaving Cream

Stearic Acid	40 lbs.	Carbitol	3 lbs.
Lanolin	7 lbs.	Triethanolamine	3.3 lbs.
Mineral Oil	18 lbs.	Borax	3.7 lbs.
	Water	125 lbs.	

Melt the stearic acid, add the lanolin and bring the temperature to about 70 degrees C. Heat the water, triethanolamine and borax in a separate container and when at the boiling point, add the acid solution. Stir vigorously.

Through their research departments and by coöperating with other industries, petroleum refiners are constantly seeking new and more profitable outlets for their products. Petroleum is no doubt the most important commodity used by man today, and its usefulness is constantly being extended by the development of new products. In recent years markets or plant use has been developed for all refinery by-products, including acid sludge and coke. In addition to the products described in this article there are numerous other petroleum specialties, including medicinal oils, petroleum jellies, wax and candles.

[5]Standard Oil Bulletin, Dec., 1931; Jan., 1932.
[6]Booklet on Emulsions, Carbide and Carbon Chemicals Corp., N. Y. City.

Drill-Hole Orientation An Aspect of Proper Well Spacing

By WARREN L. BAKER

CONSIDERATION of proper well spacing for the purpose of more efficiently and economically draining any oil field of its oil reserves eventually leads to the subject of straight-hole drilling and orientation of holes from vertical; for, correct surface spacing of wells is of little benefit if, at least, fairly vertical holes are not drilled. The sub-surface point of penetration into the reservoir may be so far removed from that directly beneath the surface location, in cases of crooked holes, as to drain practically an entirely different radius, or portion, of the oil sand than expected or desired, thereby losing all the advantages obtained by proper surface spacing. Realization of this condition, from thorough studies made during the past several years of the vertical inclination of drill holes, particularly their direction, has made straight-hole drilling and the determination of bottom-hole locations important and vital aspects of well spacing.

In conducting any well spacing program, it is essential that the exact location of the bottom of the well, or wells, be definitely determined as it is the bottom location, and not the surface, that actually represents the exact drainage area of the wells within any tract of acreage or field. A number of oil companies are now surveying their wells and making plats or maps of the bottom-hole locations. It is necessary in platting bottom-hole locations that not only must the inclination degree from vertical be known, but that the direction of the course taken by the well also be charted. Without an orientated inclination survey of the well to determine if the variation is to the north, east or south of the surface location, attempts to discover the area being drained by a well are of little value.

The importance of determining the bottom-hole location of producing wells is best conveyed by the accompanying illustrations. Figure No. 1 shows surface locations and an assumed drainage area for 16 wells on a 160-acre tract, while Figure No. 2 illustrates some of the conditions that might actually take place beneath the surface because of off-vertical direction of the holes.

It will be noted from a study of the drawings that it is easily possible, and it is often the case, for two wells to be quite close to each other where they penetrate the sand, whereas, on the surface, standard spacing regulations were followed. For example, in a 4000-foot well having a continuous deflection of five degrees from vertical from top to bottom, the bottom of the hole may be at a distance of 349 feet in any direction from a vertical line through the center of the surface location. If another well is likely to be closely situated, this condition makes for poor drainage, as the two wells will be drawing their oil from practically the same area. No doubt, this is frequently the cause of small wells, or quick declines in pressures of wells which, apparently, are well located on the producing structure.

Recently, a Mid-Continent oil company made a location in an old field, but before commencing drilling operations decided to make a directional survey of the old offset producer. The orientation test showed the old well was producing from a point only 50 feet away from the proposed location, consequently, it was considered inadvisable to drill in the new location.

The problem of proper well spacing has become of vital importance during the last few years since holes have been carried to greater depths; and the question of directional surveys of the vertical deviation of the bore-holes has increased proportionately in importance. In deep wells slight deviation from the vertical may become determining factors in deciding whether or not to straighten the hole, as the deeper the well the greater is the chance of wandering far from the surface location. Likewise, it is much more important in deep fields that proper drainage be procured because of the increased expense of drilling the wells.

According to Dr. F. H. Lahee, Sun Oil Company, Dallas, Texas, "no greater angle of deviation can be safely permitted in the drilling which at any given depth would eventually displace the bottom of the hole more than half the distance between offset wells in the particular field." Using this rule as a guide, Table No. 1 gives the limiting angles for wells from 4,000 to 8,000 feet in depth.

From this table, it may be seen that for proper and efficient drainage in deep territory, close well spacing is undesirable, and that the point where the inclination is great enough to become objectionable is a matter of judgment influenced mostly by a knowledge of the direction in which the inclination occurs.

Through the use of orientation survey data of all wells drilled on a lease, a company may determine an even better well spacing plan for efficient drainage during final stages of exploration than if a standard program were followed. The company may also benefit materially by limiting the variation from vertical during drilling operations. These two factors alone, are well worth the time and expense of surveying the wells with some of the reliable instruments now offered for use.

Depth of Well in Feet	WELL SPACING IN FEET			
	330′	660′	990′	1320′
4000	2° 20′	4° 45′	7° 05′	9° 30′
5000	1° 55′	3° 45′	5° 40′	7° 35′
6000	1° 35′	3° 10′	4° 45′	6° 20′
7000	1° 20′	2° 40′	4° 00′	5° 25′
8000	1° 10′	2° 20′	3° 30′	4° 45′

Table No. 1, showing limitations of deviation angles from vertical if bottom locations are not to be more than half the distance between offset wells.

It is not unlikely that the future may see the adoption of plans to set limitations on the inclination from vertical on drilling wells, based upon the well depth and surface spacing of the wells, which action should result in an extremely improved oil reservoir drainage condition.

Well spacing programs need to be divided into two major studies, namely: the proper or the best surface spacing and the correct bottom-hole location and spacing. There are so many factors entering into both studies that they cannot be considered here, and since the surface spacing is based largely upon the individual characteristics of the different areas it will be left out of this discussion.

Correct bottom-hole spacing is based upon two factors: After the surface location best suited to the local conditions has been decided upon, these are: first, the drilling of a straight-hole, and, second, changes in original well-spacing plans to compensate for the deviation from vertical of wells already drilled. In either case, it is essential that the degree of inclination from vertical and the direction of the deviation be determined.

For straight-hole drilling, these determinations of verticality must be made periodically during actual drilling operations. There are many advantages in determining immediately when a hole exceeds the limiting angle of inclination, but the principal one is the ability to take early steps to straighten the hole. Frequently, such action saves the loss of many feet of hole, besides, sometimes, preventing mechanical difficulties encountered in very crooked holes. Unless the deviation from vertical in a drilling well exceeds the established or desired limitations it is not so necessary that the direction of the angle be located.

After several wells have been drilled in an area, particularly where inclination measures were not made during drilling operations, both variation from vertical and the direction of the deviation should be determined so as to find out the exact location of the bottom of the well. These, when mapped, may save expense, and be a guide to more correct spacing and drilling of additional wells. The value of such maps for additional locations can readily be seen, as while during drilling operations the degree of inclination in an offset well can be controlled and regulated so as not to be within the drainage area of the completed offset.

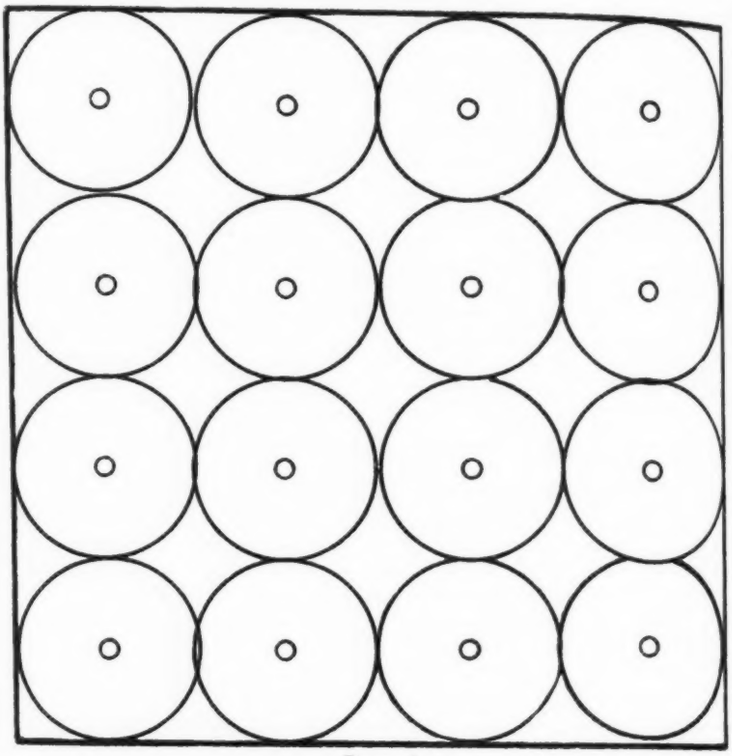


Figure 1

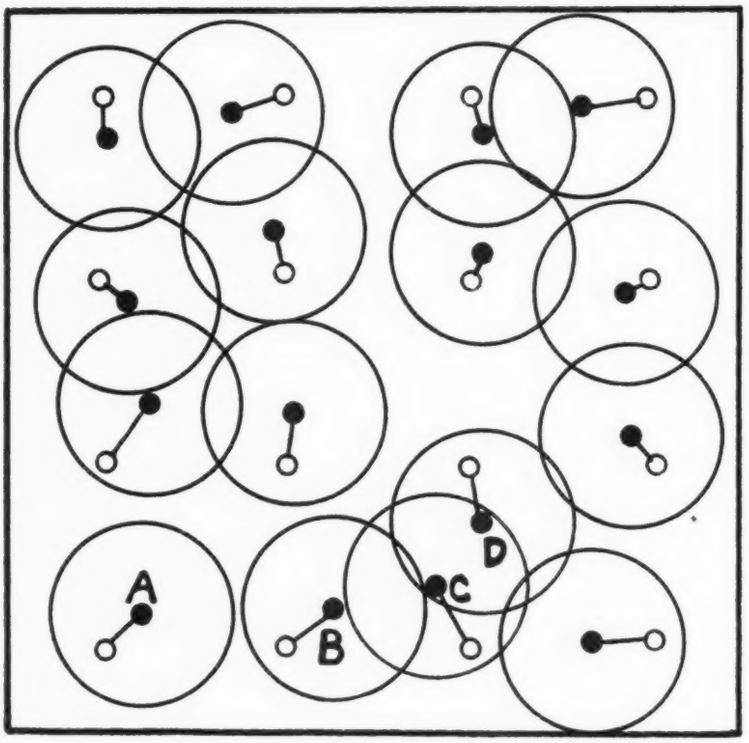


Figure 2

Explanation of Figures 1 and 2

Figure No. 1 is an illustration of standard 10-acre to the well spacing program for a 160-acre tract and an assumed drainage area for the 16 wells. This drawing is based entirely upon surface location of the wells.

Figure No. 2 shows the drainage area of the 16 wells, as based upon an assumed deviation from vertical of the wells. Assuming uniform structural and sand conditions over the entire tract, well A (lower left-hand corner) should be the best producer, as it has a full allotment of drainage area, while wells B, C and D are closely spaced and are likely to be small and show rapid decline. Note the area remaining outside the drainage circles.

Note: Large circles represent the assumed drainage area of the wells, the small solid circles in Figure 2 are to denote bottom-hole locations and the white-center small circles are surface locations.

Recent Developments in Stabilizer Temperature Control

By LOUIS H. BRENDEL, Neilan Company, Ltd.

ADVANCEMENTS have followed close upon each other's heels in the design of stabilization units and plants during the past three years. With the discovery of a commercial use for one after another of the formerly so-called waste products, have come more insistent demands for exact cuts. Now with the widespread concentration on the subject of "octane rating," refined methods of control are being zealously sought.

One of the most important, as well as what has long been one of the most difficult, controls on a stabilizer is the temperature of the reboiler. This, as most readers know, has been controlled with varying degrees of accuracy but the very characteristics of the hook-up have frequently caused overrunning of the controlled temperature. This tendency of the controlled temperature to fluctuate on either side of the desired temperature is known as "hunting."

An interesting advancement in the control of reboilers has recently been made. As it has been with so many worthwhile developments in all lines of endeavor, this embodies a principle so basically simple that one wonders why it was not apprehended sooner. Actually it consists of a method of mechanically interconnecting the temperature, being controlled with pressure and rate of flow of the heating medium in the same temperature control instrument. The close interrelation of the controlled temperature and the pressure and rate of flow of the heating medium has been appreciated for some time by many engineers. In fact, some have found that inserting a steam reducing regulator ahead of the diaphragm control valve supplying the heating medium to the kettle provided much closer temperature control. All that prevented this scheme from being the real answer to the problem was the fact that as the operating conditions carried the reducing regulator would have to be reset to provide a new rate.

With this innovation in control, a pipe is led from the down-stream side of the diaphragm control valve to the temperature control instrument. Through suitable mechanism this pressure is utilized to automatically reset the control valve so as to supply the heating medium at the proper rate.

As many know, a change in the indicated temperature of the reboiler is frequently preceded by a variation in the rate and pressure of the heating medium going to the reboiler heating coils. This variation has been found from research and experiment to precede the reboiler temperature change by anywhere from 30 seconds to 3 minutes. It is apparent that this might be the result of (1) varying the rate or temperature of the make-up in the vessel, (2) variable upstream pressure of the heating medium, (3) periodic emptying of the steam traps.

It was thought that this anticipatory variation in the pressure of the heating medium might be utilized to correct itself before the temperature in the reboiler indicated a change. This has been accomplished by ingeniously close-coupling the regular helical temperature coil with a helical pressure coil. This pressure coil is connected to the downstream side of the heating medium control valve. The temperature coil is attached to a temperature bulb inserted in the reboiler in the regular manner.

As can be readily appreciated, such an instrument is exceptionally sensitive, due to the fact that the slightest variation

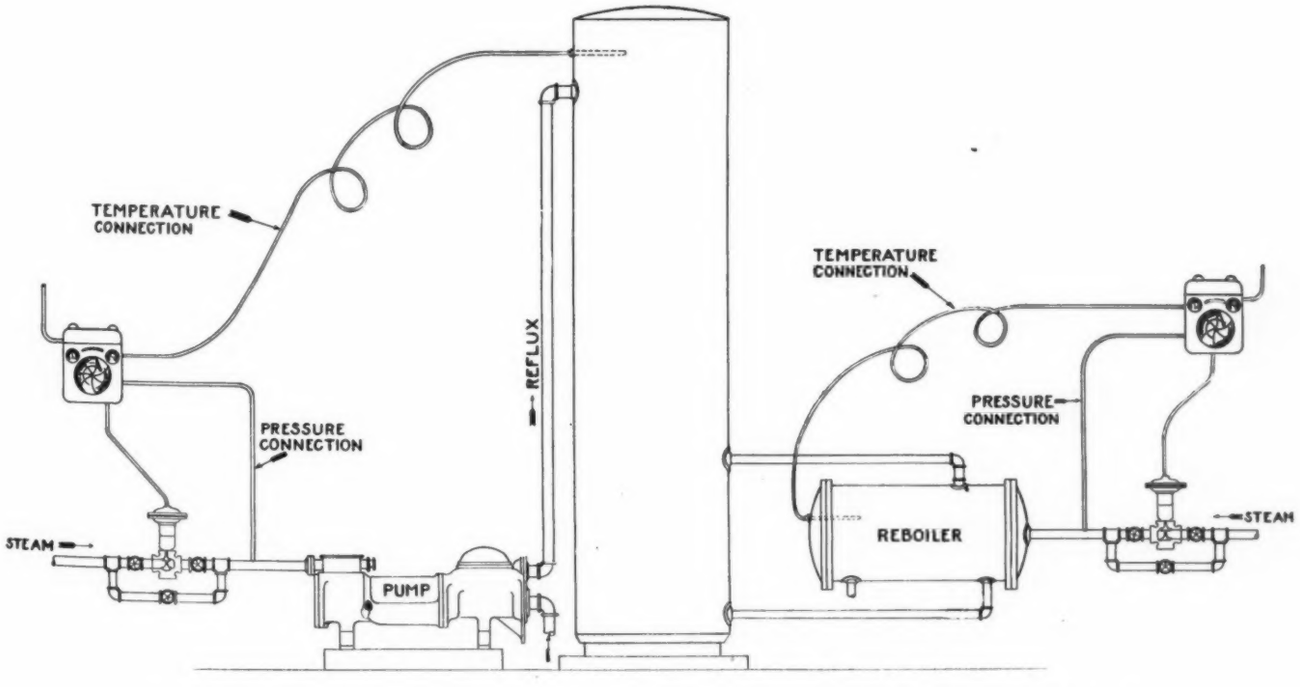


Figure 3. Sketch indicating how thermo-pressure compensated instruments are installed on a stabilizing unit.

in the heating medium actuates the helical pressure coil so as to compensate the rate of this medium at least 30 seconds before the indicated reboiler temperature change should take place. Although it sounds paradoxical, this new type of temperature controller is in reality correcting temperature fluctuations before they occur. So efficient is this new thermo-pressure compensated instrument that many reboilers using it are obtaining closer temperatures than ever before. (See Figure 2).

Equal success is being experienced through the application of this new method of control for stabilizer "top temperatures." Here is another point on the average stabilization unit at which it has always been difficult to maintain exact temperatures. The only real difference, however, is that here the medium is producing a cooling effect rather than a heating.

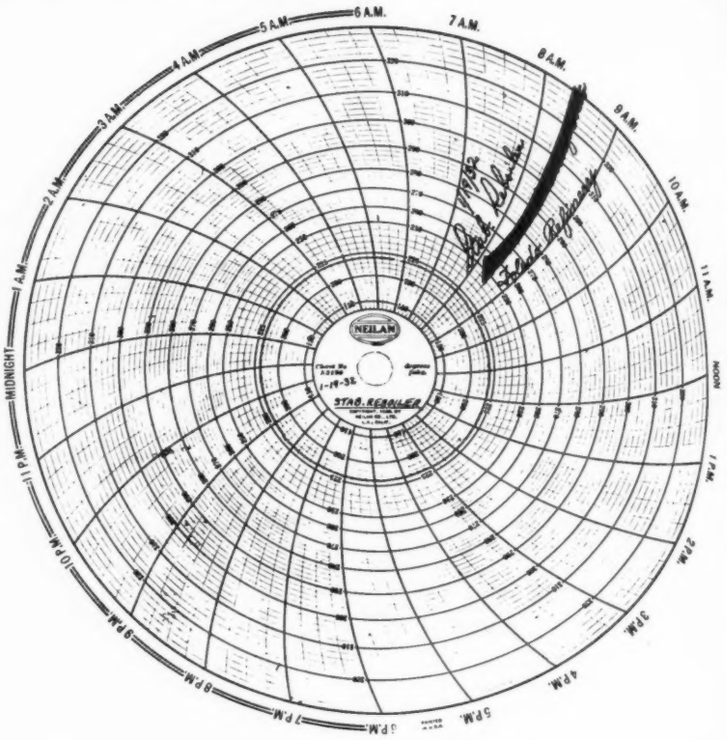
In this installation the control valve of the temperature instrument is generally installed in the steam supply line to the reflux pump. Thus the temperature is being controlled indirectly rather than directly. By "direct," we mean installations where the control valve is directly installed in the line supplying the heating or cooling medium. In contrast by "indirect," we mean hook-ups in which the control valve controls the speed of a pump which, in turn, supplies the heating or cooling medium.

It is only natural that with the indirect control so common on "top tower" problems that cycling, surging or hunting are far more common than on some other installations. Obviously this tendency of the temperature to fluctuate makes this compensated temperature controller more desirable. In this particular service the pressure or rate of flow connection is taken from the steam supply line between the control valve and the steam cylinder of the reflux pump. Results are justifying the confidence in this inter-related controller; and steady, stabilized temperature charts are the result.

Present economic conditions are making drastic demands for higher efficiency from plants a few years old. It is a case of the survival of the fittest. Plant engineers are finding that many a plant which is "slipping" can have new blood injected into it through improved controls. Not only temperature; but pressure, flow and liquid level controls as well.

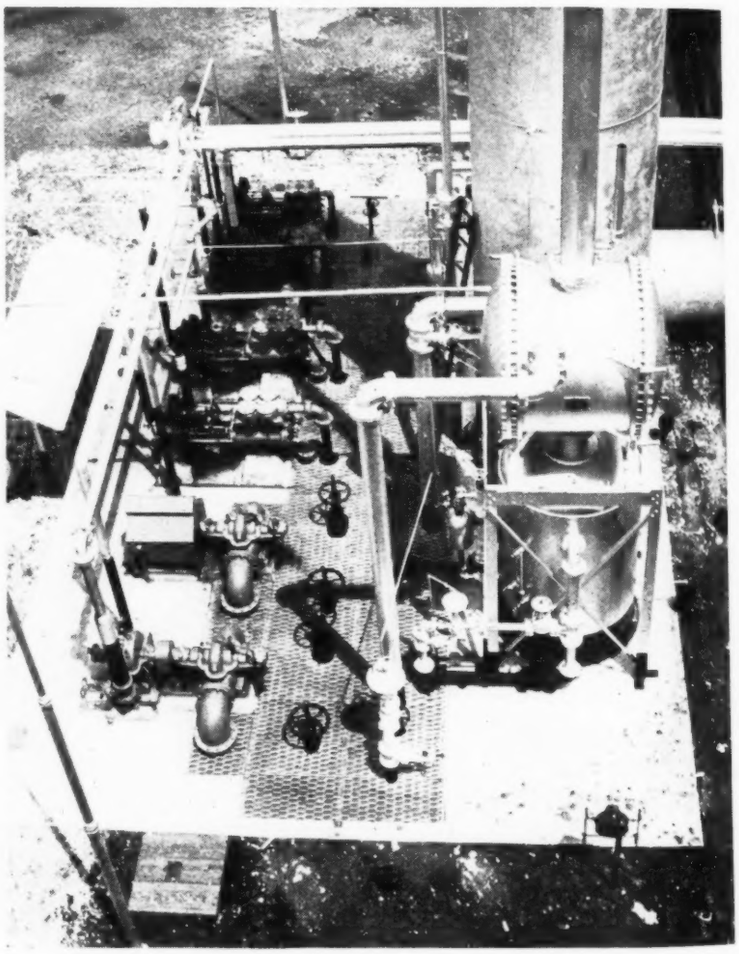
This consciousness regarding more exact control is not unique with the oil industry by any means, but is making itself felt in each and every one of the process industries. An outstanding example of this is in the food industries which have recently had new and higher standards imposed upon them by the government. The edict that all food stuffs manufactured or canned must bear a label stating that they are "sub-standard" if they fail to measure up to the governmental standard is causing many plants and canneries to be equipped with new control equipment.

Refinements in temperature control such as the one briefly described in this article are of vital importance to the petroleum industry, not only because they make possible the development and perfection of new processes, but also because they provide a means of greater efficiency and economies with older installations.



Above: Figure 2. Chart showing accuracy with which reboiler temperatures are being held (220 degrees F. in this case).

Below: Figure 1. View of modern stabilizer column equipped with new type temperature controller.



Estimating Refinery Construction Costs

By G. W. HEINECKE

THERE are many ways of estimating the cost of plant installations, ranging from those which are wild guesses to those made by experienced estimators, assisted by cost records of actual installations of similar, although not identical, nature.

It is to be understood that estimating is not an exact science, even with specialists, and the best of estimates are close guesses based on past records and experience in which the saving made in overestimating one item, or operation, is expected to cover the loss incurred in underestimating another so that the sum total of all costs of the installation will approximately equal to sum total of the complete estimate.

Material prices often change between the time of estimating and when authority is received to proceed with the installation, and labor costs are variable in the extreme. With an organized construction crew, made up of high class, seasoned workmen, but with different construction foremen, the labor cost will vary widely. The same condition prevails when the same foremen prosecute the work but with a different crew. This is also true where there is a large labor turnover in the construction crew.

Errors in the engineering and drafting office, requiring changes in equipment and field work already installed, the nature of the soil, whether soft soil, hard pan or rock, the type and quantity of erection equipment available, weather conditions, lack of material on the site when required, causing delays, are just a few of the sources of error, and make accurate estimating well nigh impossible, even with first class finished drawing available on which to base the estimate.

Finished drawings are of prime importance but are seldom available, usually only a flow sheet and a rough plot plan showing sizes of equipment, operating pressures and temperatures, pipe sizes, and approximate locations of major equipment being furnished the estimator. In an installation to be operated at high temperatures or pressures, accurate piping drawings should be furnished, for valves and fittings for such installations are expensive and a few omissions will cause this item to be badly underestimated.

In accordance with the above, a method of estimating is herewith presented which may be used and which has, in a modified form, proven successful. It is not claimed that this is the best possible method, but it is hoped that with the information here given, the construction engineer or refinery superintendent will be able to build up a system of estimating that will make it possible to produce nearly accurate estimates and, as a result, secure the necessary appropriations with less effort to carry out the project. The labor cost is in some cases based on the cost of the material. In other cases it may be included with the material, the installed price having been secured from the manufacturers of such material and would be an estimated contract price, installed. There are many items that can be furnished by established manufacturers at much lower cost than they can be fabricated in the field by the construction crews. These manufacturers have well equipped shops and highly skilled workmen and as a general rule their products are far superior to home made equipment. They also maintain a highly organized estimating department, covering products of their manufacture and are willing and ready at all times to assist in any way possible. When such a condition arises, it is well to call upon one of them for assistance.

If the estimator is a member of the office force, as is usually the case, he should not hesitate in securing information from the various labor foremen. Such information is of paramount value and often spells the difference between an excellent and a worthless estimate. Whatever information he gathers should be immediately indexed and filed for future reference. Time consumed in indexing such information is well spent. In this manner a great amount of information is obtained, and the necessity of calling on the foremen more than once for the same information is eliminated. Should any radical changes develop in labor conditions later, it may be necessary to get new information from the foreman.

It is important to have all estimates checked in order to make sure that no items, or parts of items, have been overlooked, and that prices, extensions and totals have been accurately made.

It is well to have one man, or group of men, make all estimates. This develops speed and accuracy. Such men should have a general engineering and designing knowledge, especially as relates to refinery practice, a fair sense of values, a good personality, an aptitude for such work and be proficient in reading drawings.

A refinery is usually divided into units, or plants, such as pipe stills, boiler, power, skimming, cracking, rerun, debutanizing, treating, vapor recovery plants, etc. Complete plants are frequently, and complete refineries are practically always, designed and built by equipment companies as turnkey installations. For purposes of illustration only, items included in one plant, such as a skimming plant, will be used.

The proposed installation is divided into its component parts, or items, endeavor being made to arrange the items, so far as possible, in the same sequence followed in constructing the job. Following is a list of items in their sequence. These items may be changed and items may be added as found necessary to suit conditions.

Item 1. Equipment prices, such as towers, exchangers, tanks, pumps, etc., which are best obtained directly from the manufacturers of such equipment. If second hand equipment is to be used it should be marked second hand, for such equipment may no longer be available when the decision is made to install it. The estimated cost of second hand equipment should be listed in such a way as to show its purchase price or salvage value, the cost of dismantling, such as rigging, etc., and the cost of putting the equipment in first class shape which is usually very high. The sum of these costs constitutes the total cost. Unless a very decided saving is made in using reconditioned equipment, and especially that to be purchased in the open market or in place in some other plant, it is best to purchase new material. A piece of equipment to be bought "as is" from some unknown shut down plant is a poor risk indeed, particularly if it is to be operated under pressure. There is no assurance that such equipment will withstand the pressure unless a costly inspection is made.

Item 2. Controls, such as temperature recorder controllers, flow recorder, liquid level controllers, etc., prices of which can be obtained from the manufacturers of such equipment. This item may be included in item No. 1 and the same objections to second hand material also applies as in that item.

Item 3. Plant Site.—includes clearing and grading, surveying, building roadways, maintenance of plant site during building operations, final clean up of plant and removal of trash and excess dirt.

Item 4. Temporary buildings and installations, such as

tool house, superintendent's office, and temporary water and power lines.

Item 5. Foundation.—Includes all material, labor and contracts incident to the building of foundations. Among the materials, beside the cement, sand and rock to make up the concrete aggregate, are the form lumber, piling when used, anchor bolts and sleeves, and reinforcing rods. The labor includes excavation, form work, mixing concrete, pouring concrete, removal of forms and back fill. If piling is used, pile driving must be included. Hauling and rental of concrete mixing equipment should also be included.

Item 6. Sumps and other concrete installations such as pipe trenches, retaining walls, fire walls, blow pits, etc., which are not included in item No. 5.

Item 7. Steel structures such as platforms, ramps, stairs, loading racks, etc.

Item 8. Erection of Equipment.—This item includes all material and labor required to erect the equipment and set it on the foundations. In it is included erecting and removing gin pole, cribbing, etc., and grouting and leveling.

Item 9. Piping includes all pipe, valves and fittings, pipe trenches (not including concrete pipe trenches which are included in item No. 6), supports and brackets. Also installation of control equipment.

Item 10. Building.—All material, labor and contracts involved in all permanent buildings whether of brick, concrete or steel.

Item 11. Insulation.—All material, labor and contracts, including staging, incident to covering equipment and piping.

Item 12. Painting.—All material and labor involved.

Item 13. Electrical.—Includes all material, labor and contracts for all permanent power and light lines and connections involved in electrical control equipment.

Item 14. Starting and Servicing Plant.—Minor adjustments incident to placing the plant on stream, testing temperatures, pressure and products, and making recommendations for changes required to improve either products or operation, or both.

Item 14. Plant modifications includes all material and labor charge due to changes in plant to improve products or operation.

Item 16. Freight.—All railroad freight, express, hauling and trucking of equipment and other material except material shipped F. O. B. site.

Item 17. Travel Expense.—All transportation, board and expense accounts of authorized individuals.

Item 18. Supervision and Clerical.—Salaries to superintendents and clerks, communications and office expense items.

Item 19. Insurance and Permits.—This item includes fire and loss insurance, compensation insurance and construction permits whether building or electrical.

Item 20. Drafting.—Includes all drawings, specifications and bills of material required.

Item 21. Engineering.—Includes charge for any consulting engineering work required. Also for work of office engineers. This item may be included in item 20.

A miscellaneous and contingency item should be added. This item includes a sum for small miscellaneous material and work which is not included in previous items and a contingency intended to cover such items as may have been overlooked.

The foregoing list covers practically all the items encountered in the average construction job, although there may be some special items which have not been included. Some items overlap and in such a case the experience and judgment of the estimator serve as the best guides in placing such details.

Costs of individual pieces in each item may be listed on common letter sized paper, but frequently printed forms are used and are preferred. In the costs are listed material, labor, freight and any other cost that may enter into the erection of each individual piece in its permanent location. When all individual pieces in one item are listed they are summarized and placed on a summary sheet similar to that shown, in the columns marked "estimated." After the items listed have been installed and the costs analyzed, they are placed in the summary sheet in the columns marked "actual." A glance will then show which items have been underestimated or overestimated, and form a basis for future estimates. A copy of this summary sheet should be filed with the original estimate. Should the difference between the estimated and actual costs vary greatly, an investigation should be made to determine the causes of such variations.

If the foregoing ideas and procedure are carried out, it will be possible in a short time to build up an efficient system of estimating.

Est. by_____ _____ OIL COMPANY Est. File_____
Chk by_____ SUMMARY CONSTRUCTION ESTIMATE SHEET Est. Date_____
App. by_____ Project_____ Comp. Date_____

Item No.		Material		Labor		Freight & Cartage		Contracts		Total	
		Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.	Est.	Act.
1	Equipment Prices										
2	Controls										
3	Plant Site										
4	Temporary Installations										
5	Foundations										
6	Sumps										
7	Steel Structures										
8	Erection of Equipment										
9	Piping										
10	Buildings										
11	Insulation										
12	Painting										
13	Electrical										
14	Starting and Servicing										
15	Plant Modifications										
16	Freight										
17	Travel Expense										
18	Supervision and Clerical										
19	Insurance and Permits										
20	Drafting										
21	Engineering										
	Sub Total										
	Misl. and Contingence										
	TOTAL										

REMARKS:

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Paints for the Tank Farm

By DANIEL YOUNGS

DURING the past few years the paint requirements of storage facilities for the petroleum industry have shown marked and radical changes, both in methods and materials. Where there was a great preponderance of asphaltum or carbon blacks, with a small sprinkling of aluminum, ten years ago, these receptacles now glisten in the sun with whites, grays, or other light colors.

This change has not been solely for the purpose of sightliness, nor for the advertising value coincident with a well kept up refinery. Chemists, both of the petroleum and paint industries have made many tests as to the utility and value of paint for storage tanks, and these requirements have kept pace with the results of such tests.

It is, of course, obvious that not any type of paint product, whatever the shade, will give best results, or even equal results when used for this purpose. The conditions prevalent in the industry demand that specific products be used to give adequate protection and service to these tanks. The element of economy has been a most vital one, since laboratory tests have conclusively proven that great savings may be produced through the heat deflective properties of certain types and colors of paint which overcome depreciation of contents through excessive evaporation.

Years ago, Dr. Harry Gardner, Director of the Institute of Paint and Varnish Research, Washington, D. C., made some interesting comparisons between the evaporative qualities of the then commonly used blacks as against aluminum paints, showing most conclusively that light paint gave much greater economy in use than did the black. Later on, since the use of black was technically, but not actually, eliminated from consideration and use, he made further tests as to the comparative temperatures of gasoline storage tanks between aluminum and white paints.

Now, granting the advantages of the use of white or light colored paints, the requirements for such paints may be most clearly defined. It is desirable that they be free from lead which may darken from the effects of sulphur fumes or the various gases generated by refineries. A cobalt drier is effective and safe since this will show no discoloration from the effect of these fumes.

They must be weather and wear resistant to the highest degree, because of high costs if unnecessary repainting is required, and should possess both ease of spreading and excellent hiding power. When the film has worn down, after years of service it should wear by a gradual weathering rather than by checking or cracking since the latter will mean complete removal of the old film before repainting. If it has merely weathered, all that is necessary is removal of any oil spots and a wire brushing to render it free from dust and dirt before repainting. The cost of complete removal is exceedingly great when applied against usual maintenance budgets so this should be avoided wherever possible.

These paints should have such adhesive qualities as will enable them to adhere firmly to the priming coat with no possibility of breaking away, should be fairly quick drying, overnight if possible, and must have sufficient elasticity to withstand the contraction and expansion of the tanks because of temperature changes.

The priming coat naturally differs in its requirements since its purpose differs from that of the finishing coats. First of all it should have the necessary tenacity to hold firmly to the bare metal and act as a bond between it and succeeding coats. It must be rust inhibitive, non-corrosive and of the type which will best protect against disintegration of the metal. This disintegration is usually caused by the following factors:

Rust arising from moisture and dampness.
Corrosion from electrolytic action.
Corrosion caused by the presence of alkalies, acids or fumes and gases of any active chemical reagents.

Hence, the best tank primer must be one that is rust resistant, moisture repellent, have a high degree of elasticity, be alkali and acid resistant, and have insulative properties that will hold in check electrolytic action. It must also have adhesion.

Yet, given both a primer and a finishing coat with these foregoing attributes, a perfect paint job also depends upon the manner in which the surface is prepared and the paint applied. New tanks differ from old ones in that there is usually a certain amount of oil, grease, rust and scale on them due to manufacturing processes. This oil and grease may be removed by a naphtha or benzine wash, while the rust and scale is best removed by sand blasting or use of a stiff wire brush. However the entire surface of both new and old tanks must be thoroughly clean of all foreign matter if a good job is expected.

The paint coats may be applied by either spraying or brushwork, spraying being preferable because of the saving in time. It has been estimated that one spray gun will equal the work of six brush hands in the same time.

The paint should not be applied on very hot days when the metal is overly warm, for the heat will cause too rapid drying and is apt to set up so quickly that proper covering is almost impossible. Too much time should not be permitted to lapse between priming and following coats since the nature of most primers will not permit them to stand much weathering before being covered by the finish coats, usually twenty-four hours being sufficient for good drying of the primer. It is imperative, however, that it be absolutely dry, not merely surface dry, before applying subsequent coats.

If the finish coat has good body and sufficient hiding power, one coat over a red lead base primer should be sufficient. If another coat is desired, however, it is better to let the tank stand awhile before applying the second coat, which also gains additional time in the tank protection.

The maintenance of storage tanks has presented quite a problem to the petroleum industry, and has been the cause of vast expense and considerable worry, but if the fundamentals given here are carried out, and the paint purchased on a rigid insistence on these requirements for a good tank paint, it will be found that this worry and unnecessary expense will be kept to a minimum.

Daniel Youngs, the author of this article, is a resident of Hayward, Calif., who has had much experience in handling the problems incidental to tank farm paints. He has been called in by almost every branch of the petroleum industry to assist in solving problems concerning the application or longevity of paints.—*Editor.*

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Application of Automatic Time Switches Pares Gathering Costs

ONE of the greatest factors entering into the lowering of gathering costs of motor-driven stations was the advent of the automatic time switches. Gathering stations, located in widely scattered sectors of a field, usually are designed and equipped to work against high pressures, since gaugers often have a number of units on the line at the same time.

Most gaugers try to run all their batteries during daylight. It was the practice to start with one battery, gauge the tanks, open necessary valves and put the station on the line. This procedure was followed until several units were on the line and the line pressure had been built up to 800 pounds or more. By that time the first battery had perhaps been pumped down, but the unit continued to operate until the gauger could return and shut it down.

Automatic Synchronous Time Switch

Such practice resulted in a high monthly power demand charge, because the pipe line company was charged for the high horsepower requirement necessary to operate the field pumps against such a high line pressure. Power bills, too, were high because of the heavy load on the motors and due to the fact that many of the units continued to run some time after the batteries had been pumped down.

The Tidal Pipe Line Company was confronted with such a condition in the Seminole, Okla., area. Its leases are widely scattered over the field and considerable time is required for the gauger to go from one lease to another. Some time ago, steps were taken to reduce the power bills for the gathering stations with the application of automatic time switches.

With the use of the time switches it was possible to lower the demand charge to a low mark, as the pumping time for each lease was so arranged that the smallest number of motor-driven units were on the line at any one time. This made it possible to pump against a lower line pressure, bringing about lower power consumption.

Gaugers usually know within close limits the time required to pump down a battery with existing equipment. After gauging the battery, the gauger sets the time switch to start the motor-driven pump and to stop the unit at a predetermined time. He then travels to the next lease to set the time switch so that its pumping unit will be started about the time the first unit will shut down.

This procedure is followed throughout the entire number of leases served by the pipe line company. The operations are so timed that many of the gathering stations are operating during the night. Frequently the number of stations are so large that it is not possible to stagger their operation so that only one station is on the line at one time. In that event, the number of stations operating simultaneously is arranged so that the minimum of large units are pumping during the same period.

In this instance the transporting company at one time, was working against 800 pounds pressure in some of its gathering lines. Runs have since decreased appreciably but by distributing the load more uniformly over the day it has been possible to drop the line pressure down to about 300 pounds.

Under the present plan of operation the gauger has only to make one trip daily to the station. After gauging the tanks he lubricates the machinery and makes a check of the station equipment and sets the time switch to start and stop the pumping unit. Formerly he had to make a return trip and it was seldom possible for him to return at the time the unit was ready to be shut down. Too often his arrival at the station was after the battery had been pumped down, consequently more power than necesasry was consumed by the motor.

Three types of time switches are available for this work: the hand rewound clock mechanism type, electrically rewound type, which has a motor to keep an even tension on the clock main spring and the synchronous motor clock which has a motor running at constant speed and directly connected to the clock gear mechanism.

The automatic synchronous time switch, shown in the accompanying illustration, is equipped with a circular disc notched for quarter hour settings. Half of the disc is painted black to indicate night settings and the other half is for daylight settings. For this particular service the disc is equipped with two tripping arms, one to trip the starting switch and to close the electric circuits and the other to break the circuits.

The cost of the time switch equipment is relatively low and on many installations the investment was returned within the first ten days. By saving the gauger a return trip to the station his scope of duties may be widened. Another saving is in the decreased possibility of line breaks because of the lower pressures. The greatest saving, however, is the reducing of demand charges and the cutting of power bills.

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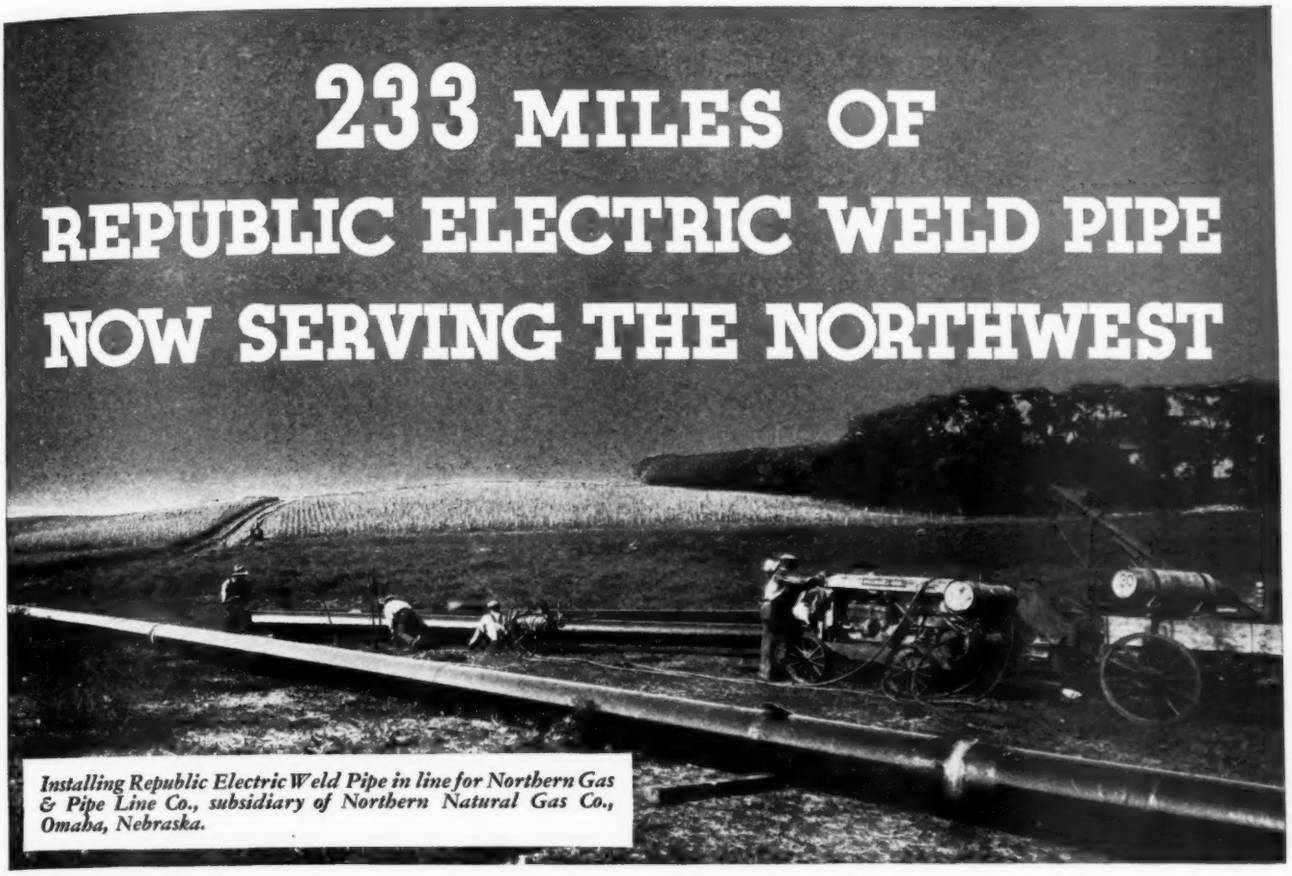

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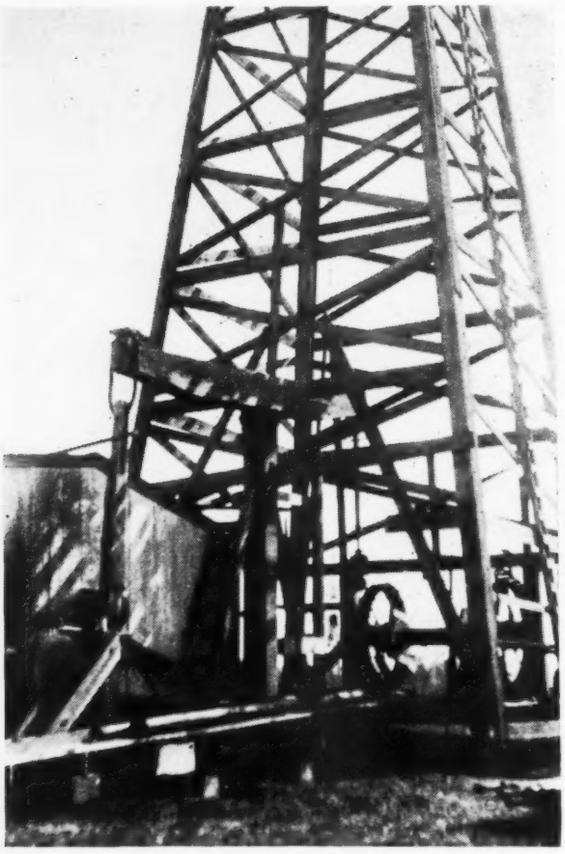
East Texas Well Completed With Cable Tools and Semi-Diesel Engine

BESIDES the discovery well in East Texas, but few have been completed with standard cable tools. One of these is the Dunklin No. 2, on one of the old Vitex Company's properties in the Joiner area. This well was drilled with rotary tools several months ago to a depth of about 3,609 feet, at which point a string of 6¼-inch casing was set and cemented. It was then shut down for some reason connected with company matters.

Recently the well was started up again and now is in process of being drilled to completion with standard cable tools by Ralph R. Ogden of Austin, Texas. With only two men on the job, and very little equipment for the purpose, rigging up at the well took about three days.



A standard wooden derrick, 64 feet high, is being used, and it is a noteworthy feature that the well is being drilled with a Franklin valveless 75-H.P., type A-0, semi-Diesel engine. Crude oil is used as fuel and the consumption is less than 40 gallons a day. Of course, it should be stated that the low daily rate of consumption is partly accounted for by the fact that drilling is in progress during daylight hours only. Power is transmitted through a clutch, clutch pulley and a 12-inch belt to the band-wheel, which is 11 feet in diameter. Drilling is carried on through the 6¼-inch casing with a string of 5¾-inch standard cable tools on a ¾-inch drilling line.

Pulley ratios in the power transmission between the engine and the band-wheel are not the most suitable that might have been chosen, and it is believed that the fuel economy could be greatly improved were the necessary changes made. With the small amount of drilling to be done on this well the owners did not deem it worth the trouble to make the changes at that time.

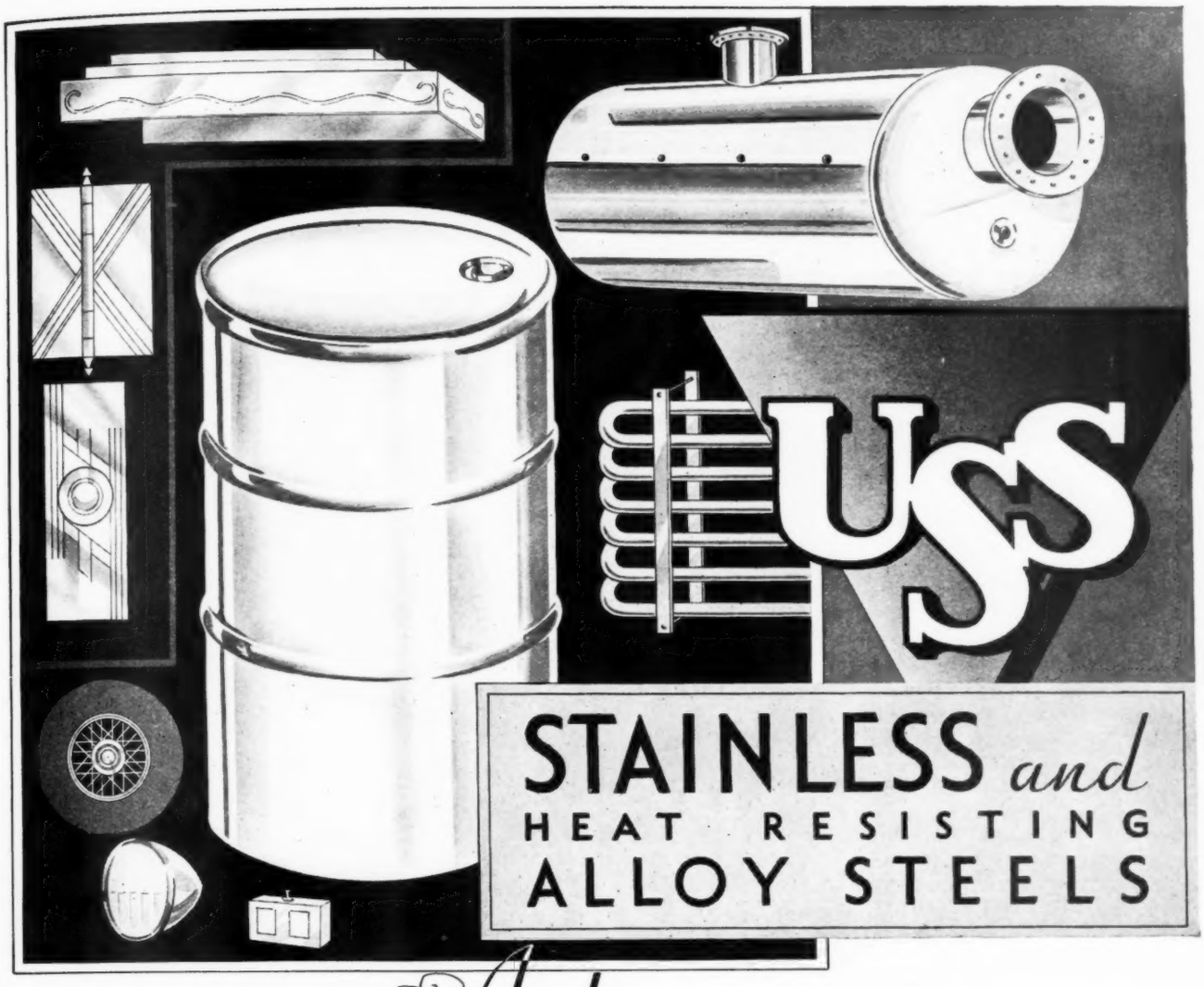
Certain desirable characteristics are possessed by this valveless type of semi-Diesel engine that appeal particularly to field men who are responsible for their operation, care and upkeep. Among these are ease of starting. Also the small number of working parts make for low cost of upkeep and consequent simplicity of operation. This means continuous operation with a minimum of attention.

When the well was visited the formation being drilled was quite hard and while no definite information was available regarding the speed of drilling with the cable tools, satisfactory progress apparently was being made. Regular pattern cable-tool bits were being used, and special precautions were being observed to keep the hole partly loaded with water at all times while drilling. In addition, drilling was being carried on through an oil saver and a regular quick-closing type control head on the casing. A ½-inch sand line was being used for bailing.

Aside from the lower cost and the fact that time is a relatively unimportant factor with the low daily allowable per well for the field in force, it is contended by the owner of the well that, in view of the diminished rock pressure in the area, drilling in with standard cable tools will reduce the hazard of mudding the sand face and impairing the productive capacity of the well.

Upper Left: Well being completed with cable tools in the Joiner area.

Lower: Another view of the Vitex Oil Company's No. 2 Dunklin in East Texas.



Adaptations

Chromium-Alloy Steels	Chromium-Nickel Steels
Ferritic	*Austenitic*
❖	❖
USS 12	USS 18-8
USS 17	USS 18-12
USS 27	USS 25-12

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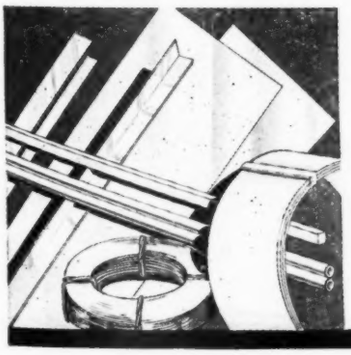

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AMERICAN STEEL & WIRE COMPANY, Chicago, - Cold Rolled Strip Steel, Wire and Wire Products
CARNEGIE STEEL COMPANY, Pittsburgh, - - Shapes, Plates, Bars and Semi-Finished Products
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Safety Devices Protect Separators From Excessive Pressures

THE development of safety and blowout equipment for high pressure gas traps has been an important achievement by manufacturers during the past year. In many instances such equipment has actually protected the separator from being "over-pressured." In the process of manufacture, a separator is tested for twice its working pressure, but, occasionally, through faulty operation, or from causes not under the control of the operator, pressures in excess of this amount are thrown upon the separator. When this happens, the separator may "blow-up." The safety blowout head, which is installed in the gas discharge line immediately above the separator, has been made by Black, Sivalls & Bryson to prevent such destruction of vessels.

The building up of an excessive pressure, when a gas line between a separator and the main line meter froze, was recently frustrated by the satisfactory performance of a 6⅝-inch safety head installed on the separator gas vent line of the Winona Oil Company's Thomas Narcomay No. 1 well, in the Wewoka, Oklahoma, field. The safety valve, set to blow-out at 680 pounds pressure, has blown out twice and each time, no doubt, has prevented the occurrence of very serious damage to the gas trap and flow lines.

The Narcomay well is capable of producing 30,000,000 cubic feet of gas and 50 barrels of crude oil per day, but only three million cubic feet of gas is being delivered into the Oklahoma Natural Gas Company's meter. The well head pressure is 960 pounds, while the gas line pressure, controlled by a three-inch adjustable flow bean, ranges from 300 to 450 pounds. The separator used is a high pressure one, having a working pressure of 425 pounds and has been tested to 850 pounds.

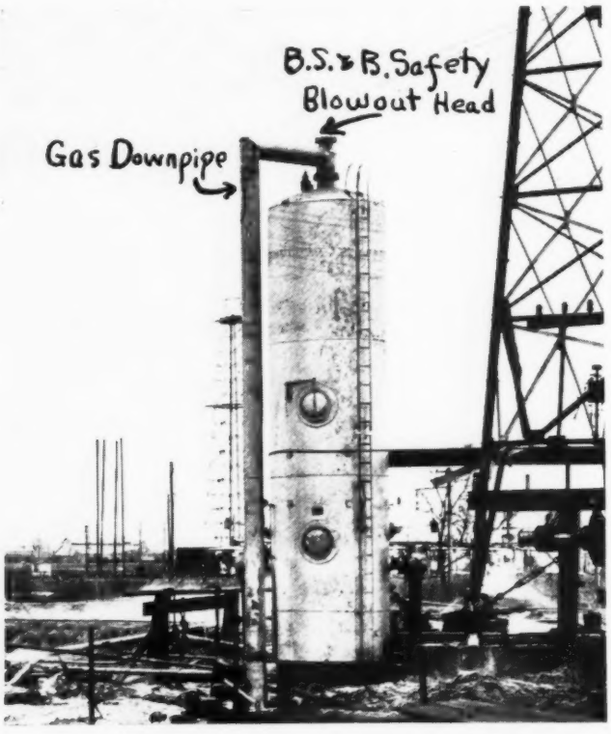
Because of the high pressure of the well and the tendency of the gas to freeze after being choked, the gas trap is equipped with many modern safety devices. These consist of a two-inch safety valve on top, set at 500 pounds; a three-inch safety valve in the gas vent line, also set at 500 pounds; in addition to the 6⅝-inch safety head (also set in the gas vent line) which blows out at 680 pounds pressure.

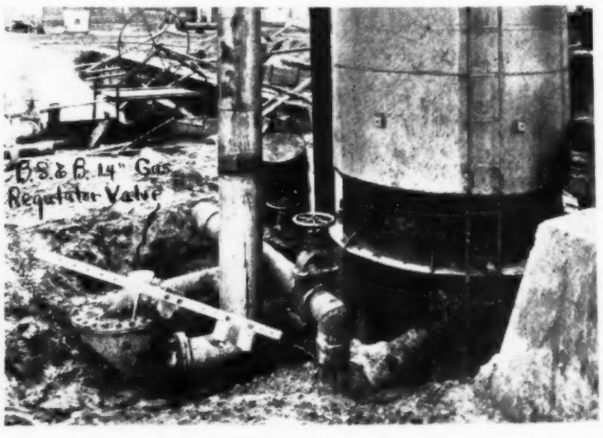
The first time the large relief valve was blown out at night, therefore, no one was around to watch the pressure gauge; but, on the second occurrence, one of the company's men saw the gauge rise above 600 pounds before the load blew the safety head out. This elaborate set-up has proven itself very much worth while, as evidenced by the fact that, on two occasions, it has prevented what mighty have been costly damages to equipment.

At Oklahoma City, the Phillips Petroleum Company's Gallman No. 1 passed 52,000 barrels of oil and 61,000,000 cubic feet of gas through an American separator in 24 hours. Because this well is within the limits of Oklahoma City, because of the tremendous volume of oil and gas which it delivers, and because of the high well pressure (2500 pounds per square inch) city authorities have required that proper measures be taken to provide safety to residents and property in the vicinity.

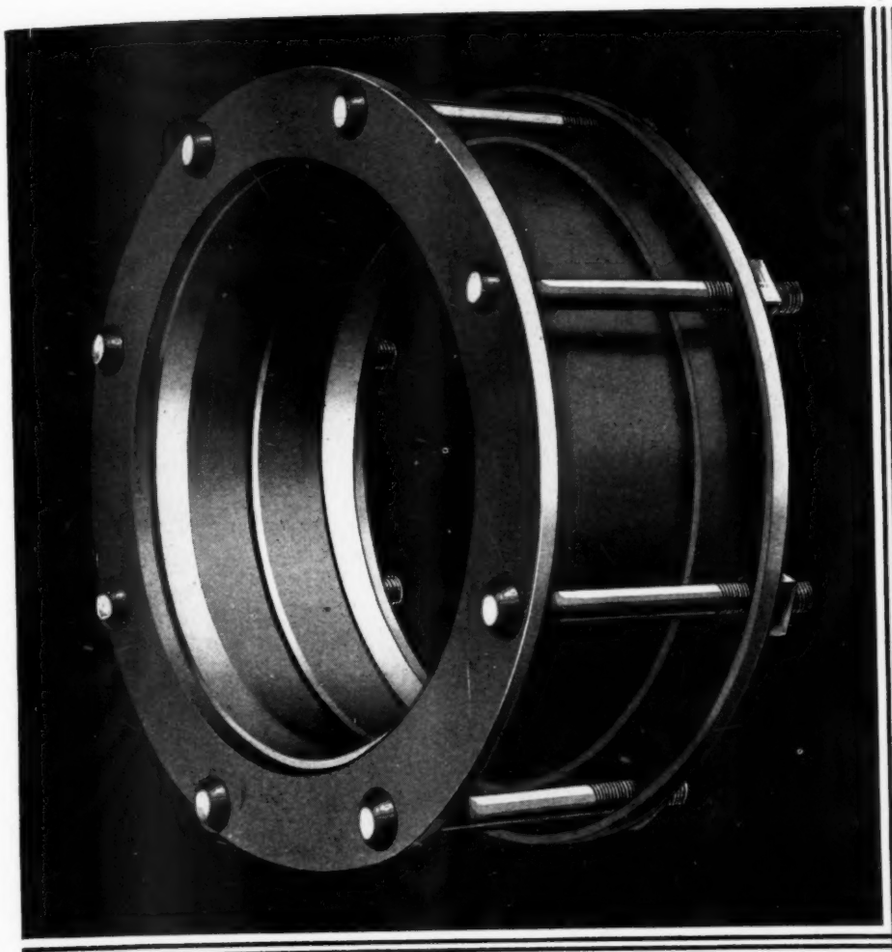
The oil is removed from the separator and the gas escapes through the gas downpipe, as indicated in one of the photographs. The oil and gas trap is designed to operate at a maximum working pressure of 150 pounds per square inch. This pressure is regulated by a 14-inch gas regulator valve, which is the largest partially balanced gas regulator valve of its type ever built for use in the oil industry. It is fabricated entirely out of steel plate, carefully welded and machined.

The safety blowout head on the Phillips company's Gallman well separator has a 10-inch copper diaphragm, of the proper thickness to blow out at 225 pounds (midway between the working pressure and the test pressure of the vessel). If the pressure in this separator reaches 225 pounds the diaphragm blows out, leaving a clear 10-inch opening to the atmosphere through which the gas may escape.





Two Views of the Separator on Phillips Petroleum Company's Gallman No. 1. Left: General View, showing safety blowout head and gas downpipe. Right: Close-up picture of 14-inch regulator valve.



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For use on plain end pipe. Uniformity of pipe clearance and flare, together with a perfect fitting gasket, assure a permanent, leak-proof joint regardless of climatic conditions.

A.P.I. sizes 6⅝ to 16 inches, with the corresponding regular sizes.

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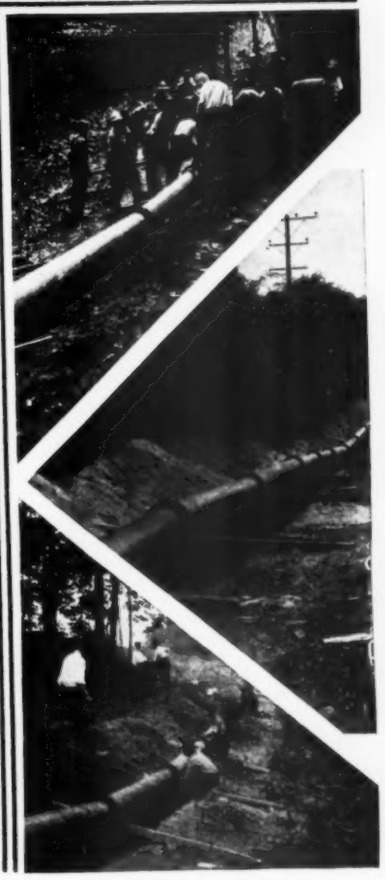


Special Application of

Fluid Level Control Reduces Air and Paraffin Troubles

. . . in Gathering Lines

OPERATING difficulties experienced on a field gravity gathering line, because of air being sucked through it when not full of oil have been overcome by the installation of a tank, the outlet of which is equipped with an automatic fluid level control. The feature of the layout is its specially designed hook-up, which is thought to be something new in pipe line work, and which also has been instrumental in reducing paraffin troubles.

One of the Sun-Yount-Lee Pipe Line Company's gathering lines in the north end of the East Texas field was originally laid so that the field gathering pumps pumped the oil to the crest of a hill whence it gravitated to the central main line pumping station. Due to proration, regulations limiting producing from each well, the line was not full of oil during the entire 24 hours, and air would be sucked into the line and later would cause trouble in the pumps at the station. Troubles from this source became so annoying that engineers of the company studied the problem and designed and constructed the present layout.

A 5000-barrel tank was placed at the crest of the hill and the line rearranged so that field gathering pumps now pump into this container, the outlet flow from which is controlled automatically by a liquid level float. Whenever the oil level reaches a certain low point the gravity line is closed so that air will not be sucked into it. When the oil level rises again the float control opens a gate valve and permits the oil to gravitate to the pump station. This method of operation has been very successful in eliminating air troubles within the line and at the pumps.

Paraffin troubles have also been overcome because of this special hook-up on the tank outlet, as it permits the application of an operating level beneath the elevation of the tank bottom. This is made possible by placing the liquid level control in a piece of 10-inch pipe, 10 inches long, which is welded in an upright position between the lower end of the six-inch tank outlet and the six-inch flow line. Control of the liquid level is obtained automatically in the 10-inch nipple and as the minimum oil level is always below the tank bottom oil is never allowed to remain for long in the tank, hence the accumulation of paraffin has been materially reduced.

The installation has been so highly successful in operation in eliminating the sucking of air into the line and in reducing the amount of paraffin accumulation, that it has created considerable interest and attention among other pipe line company engineers. The Sun-Yount-Lee engineers are justly proud of the success of the installation.

The elimination of paraffin settlings in the Sun-Yount-Lee Pipe Line Company's 5000-barrel tank on this gathering line, due to the installation of the automatic fluid level controller in such a manner that the fluid level is beneath the tank bottom elevation, carries out the belief, previously expressed by field engineers in East Texas, that paraffin accumulations in tank bottoms are not a precipitate from the fresh crude. Paraffin bottoms are formed, from all indications, in the following manner: A tank of oil is run and about a foot is left in a stagnant condition in the area below the pipe line connection. This oil below the pipe line connection is fluid and shows no paraffin sediment, but on standing, the gases and lighter ends evaporate from the surface, leaving a layer of paraffin on top of the oil, which remains intact because of its cohesive properties until fresh oil coming into the tank disturbs the paraffin. When disturbed the paraffin is broken up and due to its higher density, sinks to the bottom of the tank. The bottom of the tank serves as a medium against which the paraffin can adhere and pack.[1] Since the above description shows the method of paraffin accumulation in the East Texas field, one can readily realize how the special installation, with the float fluid control applied below the tank bottom, reduces the precipitation of paraffin. However, it is not always practical to install these installations, as pipe line companies usually require four-inches of clearance below their connections in the tank.

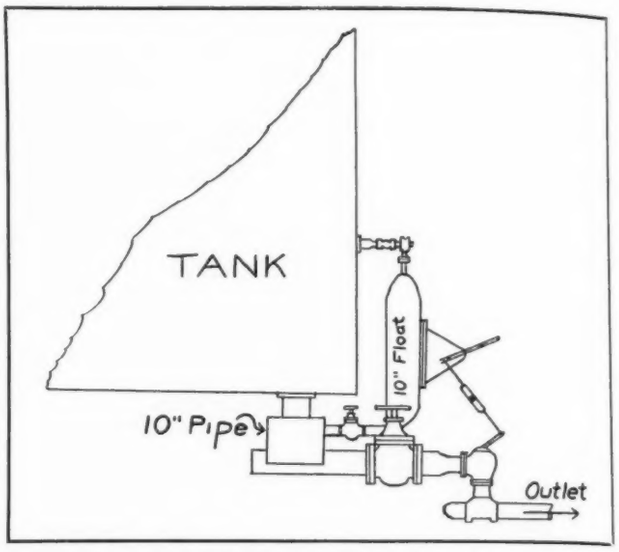
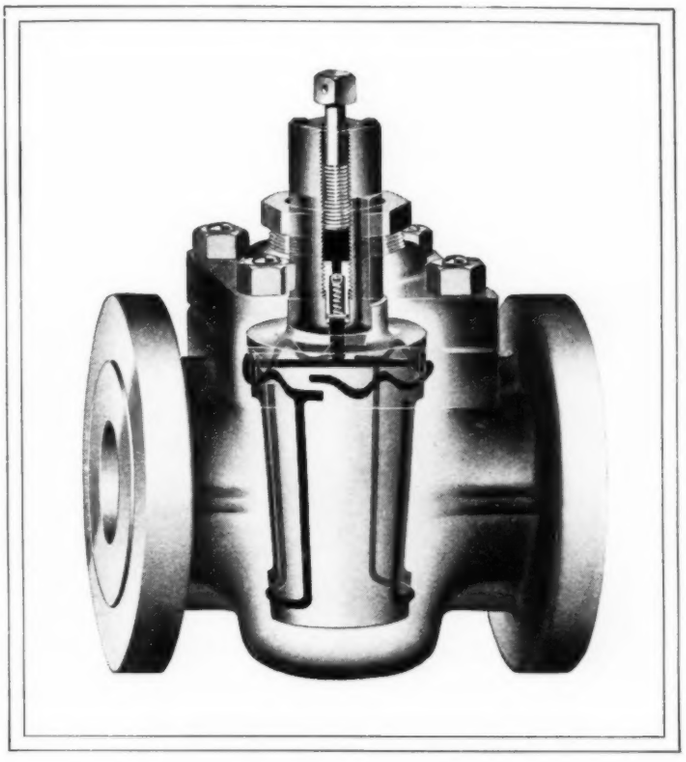


Illustration of the Sun-Yount-Lee Company's special application of fluid level control

It is interesting that the paraffin sedimentation occurs after the gases and lighter ends have evaporated, and in this connection several companies have found that the making of lease tanks vapor-tight has resulted in less breathing of the crude, consequently it has retarded the escape of the lighter ends, which in turn has proved an aid in combating paraffin troubles. Several companies have also found that by operating the oil and gas separators at vacuum, or at very low pressures, the accumulation of paraffin is somewhat retarded. This is due to the fact that when so operating no appreciable amount of vapors have been discharged with the oil into the stock tanks.

[1] *Paraffin Troubles and Their Prevention*, by W. T. Doherty and R. C. Buchan, read at the Southwestern District, A. P. I., Division of Production, at Tyler, Texas, April 14, 1932.



The experience of sixty years in the manufacture of cocks, and seventy-seven years in the manufacture of valves, has been incorporated in the design of a new line of Lubricated Plug Valves.

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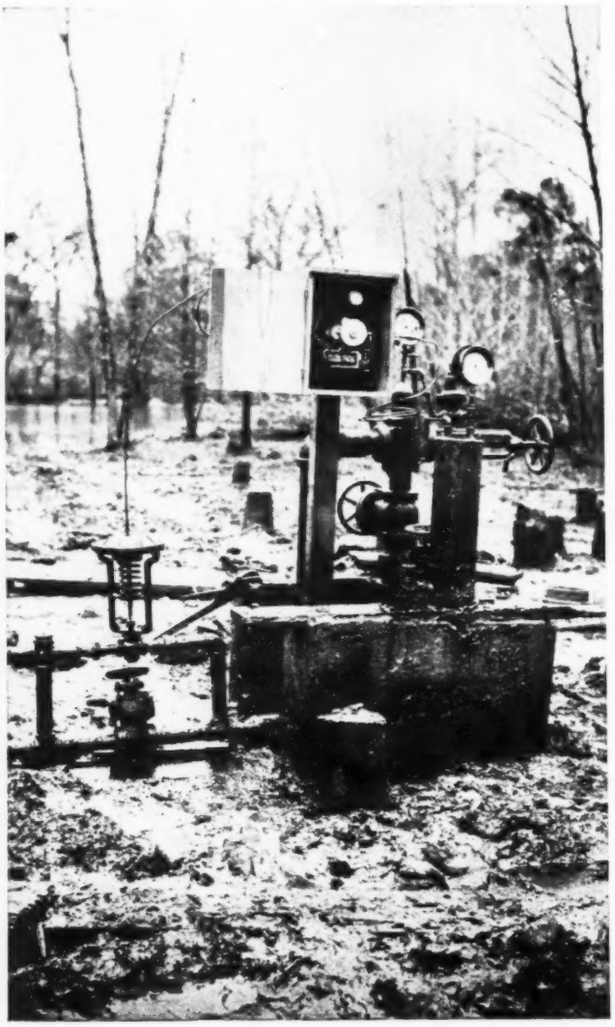
Regulator Automatically Controls

IN flowing prorated wells in the East Texas field where the daily allowable is comparatively small, it is customary to obtain the daily production during the course of a few hours' flow and then close the well for the remainder of the twenty-four-hour period. This necessitates some one making periodic trips to the well to open and close the valves. Usually the well is equipped with a flow bean of the adjustable type, which is adjusted to give the desired allowable production from the well over the course of a predetermined time interval.

If the flow of oil is actuated by the natural gas in the oil sand it is possible to flow the prorated well automatically for any predetermined time interval, thereby controlling indirectly the individual well output. A device recently placed on the market that accomplishes this is a time cycle regulator.

An installation of the regulator as used on a well in the East Texas field is shown on the accompanying sketch. The regulator has a single air or gas valve, a twenty-four-hour revolution seven-day hand-wound clock, an air or gas strainer, and a single-seated reverse acting diaphragm valve.

For the operation of the regulator the actuating medium is natural gas taken from the well head direct. To insure obtaining clean gas, to the exclusion of oil, for the operation of the regulator, certain essential provisions are in the hook-up shown on the sketch. A line of one-fourth-inch diameter pipe from the well tubing feeds into a separator tank, which, for example, may consist of a six-foot section of six-inch pipe. A one-fourth-inch needle valve is installed in the line to this unit immediately adjacent to the point of take-off from the well. To reduce the well pressure to the twenty-five pounds necessary for the operation of the equipment, a one-half-inch or one-fourth-inch reducing valve is inserted between the needle valve and the tank.



Regulator Installation on a well in East Texas. In this installation the small line from the bottom of the separator to the flow line was not connected

By adjusting the needle valve to a very fine opening, it is possible to obtain a maximum supply of gas to the instrument with a minimum accompaniment of oil. The separator tank functions as a capacity tank on the low pressure side of the reducing valve and also serves to trap out any oil carried over with the gas as well as any condensate from the gas on expansion and cooling as it passes through the reducing valve.

The reducing valve is designed to work against high pressure, which in the East Texas installation was 300 pounds. A one-half-inch regulator suitable for working pressures as high as 1,000 pounds was used for effecting in one step the reduction from the 300-pound well pressure to the twenty-five-pound instrument actuating pressure.

A one-fourth-inch valve serves as a master valve to cut the installation in or out of service.

As the diaphragm will be closed for the greater part of the twenty-four-hour period, thereby forming a "dead end" on the low pressure side of the reducing valve, a one-half-inch pop valve is installed on the separator tank as a safeguard against any possible failure of the reducing valve to close tightly and thereby allow the well pressure to be built up in the separator tank and hence against the regulator. The pop valve should be set for about forty pounds pressure. While a small gas leak would serve the same purpose, it would also allow a continuous flow from the well, even when not required, thereby bringing about an accumulation of oil in the separator tank.

A one-half-inch trap or float valve in the oil line from the bottom of the separator tank releases the oil and condensate into the main flow line at a point on the discharge side of the diaphragm valve. Only when the diaphragm valve is closed and the line pressure is lower than the separator pressure will the trap or float valve function. A check valve in the oil discharge line prevents the building up of line pressures in the separator tank while the well is being flowed.

In flowing prorated wells by means of the regulator, the operator sets the adjustable flow bean on the well to give the required production for the time interval it is desired to flow the well. The regulator then functions to open the reverse acting diaphragm valve and hold it open for the desired period of flow. This action automatically is repeated in regular sequence every twenty-four hours, for a single winding of the instrument clock at intervals of one week or eight days. The cam of the regulator is provided with an adjustable sector that will allow a total maximum adjustment equal to the fixed minimum period of flow. For example, on a cam cut for a two-hour flow period, the adjustment feature will allow this to be extended to a total of four hours.

As the well production declines the daily allowable can be maintained either by an adjustment of the flow bean or choke

Daily Output of Flowing Wells

nipple or by increasing the period of flow by means of the adjustable sector of the cam of the regulator.

Through the use of this regulator in flowing wells, it is necessary for the operator to visit the well only once a week to wind the clock. It will flow prorated wells automatically, thereby allowing one man to take care of a number of wells with ease, even on widely separated leases. Where manual control is used on a well, the number of wells that one man can handle is sometimes very limited.

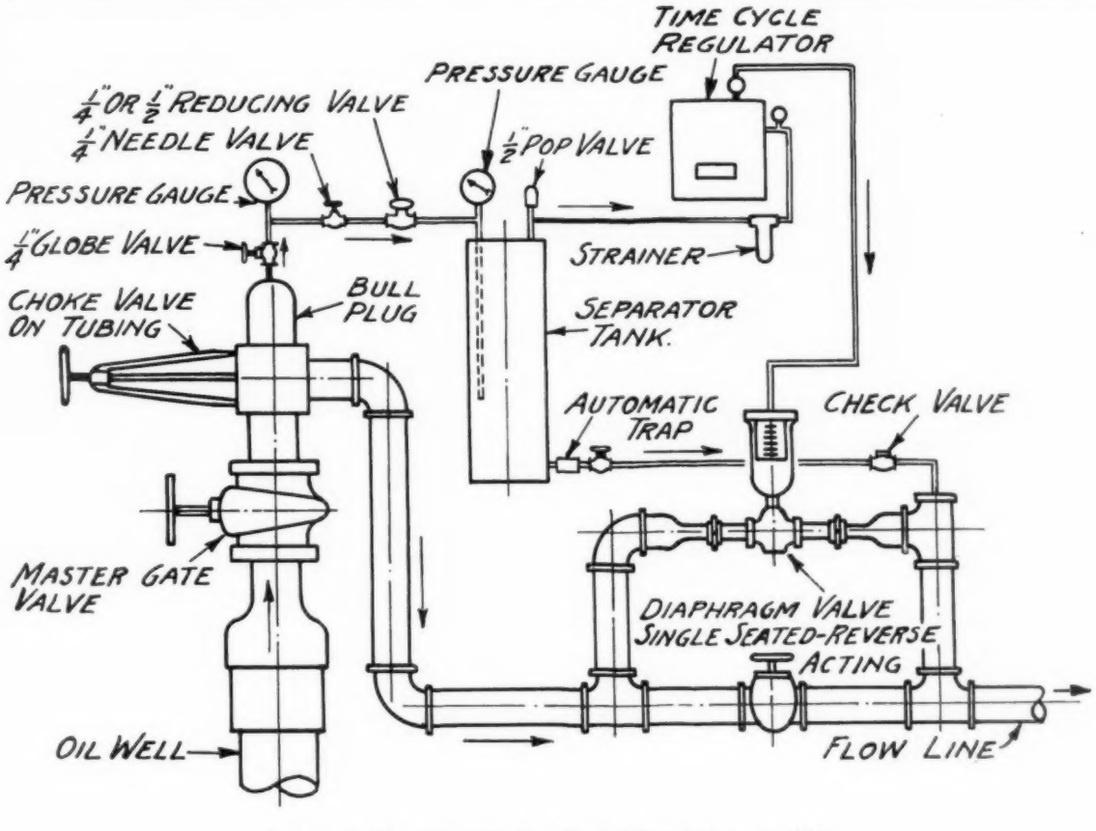
Another advantage is that in fields where it is not permissible to make up lost production, and, as in the East Texas field, where many of the wells are in swampy creek and bottom lands, which during heavy rains are impassable, thereby making the wells practically inaccessible for days at a time, it is not necessary to visit these wells daily to insure that the production for each day is made up. The use of a regulator therefore becomes a safeguard against loss of production.

On the well in the East Texas field on which the initial installation was made, and as shown in the accompanying illustrations, the shut-in pressure was 300 pounds. When the well was being flowed, the pressure dropped to between twenty and thirty pounds. As the instrument actuating pressure was taken from the well tubing, there was a corresponding drop on the low pressure side of the reducing valve during the period of flow to about eight pounds. While a pressure of eleven pounds against the diaphragm was necessary to open the reverse acting valve against a 300-pound line pressure, a pressure of only six pounds was sufficient to hold it open during the period of flow. From the fact that when the diaphragm valve closes, well pressures tend to build up quickly and the instrument actuating pressures accordingly increase, operating conditions are such that sufficient motive power was always available for the satisfactory operation of the instrument. A drop from 300 pounds shut-in pressure to thirty pounds flowing pressure, however, represents an extreme case in East Texas, for flow pressures usually are seventy pounds or more at the well.

Since East Texas crude is non-corrosive and is practically free from sand or cutting materials, valve seats and discs made from monel metal or a grade of stainless steel that is readily machineable would seem to be satisfactory.

From the standpoint of a completely automatic installation, the automatic trap in the oil outlet line from the separator tank, as shown in sketch, is very desirable. Where the tank is of sufficient capacity, however, and the needle valve in the supply line to the tank is properly adjusted, it is not likely there will be an excessive accumulation of oil in the bottom of the tank, particularly if the flow periods are comparatively short. The tank can then be blown down by opening the hand valve in the oil discharge line as the operator makes his weekly visits to the well.

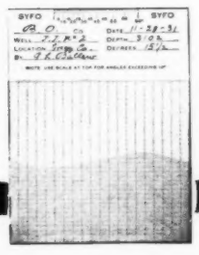
As an accessory for flowing wells this regulator has a wide range of adaptability. By its use, the daily production from the well can be restricted and flowed automatically any desired amount, thus eliminating many of the attendant evils of manual control.



Hook-up of the Automatic Flow Control Regulator on a Well

WHAT USERS SAY • No. 4

*"Are well pleased—
We have had no trouble
of any kind and have,
with minimum effort,
succeeded in accurately
checking all the wells
we have drilled"*



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LOS ANGELES, CALIF.
415 Petroleum Securities Building

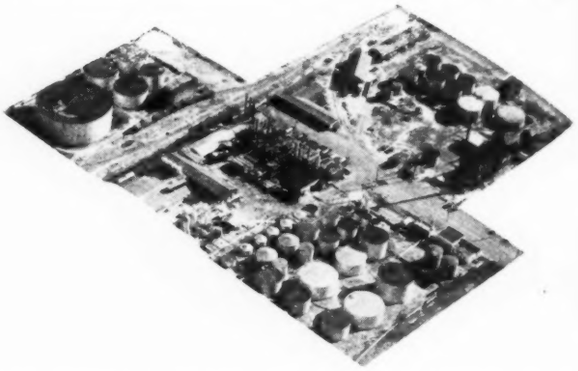
TULSA, OKLA.
402 Petroleum Building

HOUSTON, TEXAS
1417 Esperson Bldg.

SYFO Clinograph

THE INK BOTTLE

Hercules California Refinery to Be Sold



The Vernon, California, refinery of the Hercules Gasoline Company, Ltd., formerly active on the Pacific Coast as refiners and marketers of Hercules "Mule Brand" gasoline, is being offered for sale by Hubert F. Laugharn, trustee.

The plant covers approximately seven acres in the southeast industrial section of Los Angeles, and is most advantageously located with respect to transportation facilities, being served by both the Santa Fe and Southern Pacific railroads, and ideally situated for tank truck distribution in the metropolitan area.

The refining facilities consist of eight distillation units in conjunction with a Jenkins cracking plant with a combined daily throughput of approximately 8,000 barrels. Complete Foamite fire protection facilities are already installed.

The real estate has been appraised at $153,000, is clear and owned in fee by the company.

Complete treating plant, tankage approximating 250,000 barrels, and other manufacturing facilities provide a combined refining unit capable of full capacity available for immediate operation.

Complete technical details of this plant are given in a booklet which may be secured from Hubert F. Laugharn, Trustee, 633 Subway Terminal Bldg., Los Angeles, Calif.

Dehydro Suit Against Tretolite Dismissed

The $100,000.00 damage suit brought by Dehydro, Inc., of Tulsa, Okla., against the Tretolite Company of St. Louis, Mo., came to trial in the Federal Court, Northern District, Tulsa, Okla., on June 20, 1932, Judge Kennamer presiding. After the introduction of two days of testimony by both sides the court dismissed the suit against the Tretolite Company.

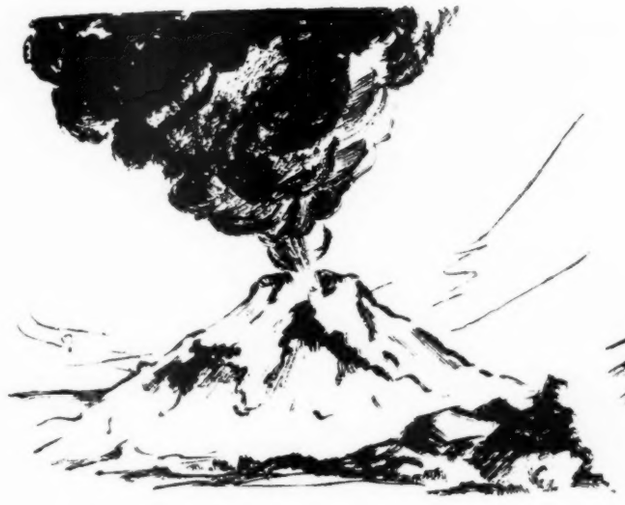
Neilan Company Has New Chicago Office

The Neilan Company, Ltd., of Los Angeles, manufacturers of automatic controlling devices for temperature, pressure and flow, announce the opening of a new office in Chicago at 1525 East Fifty-third street. Mr. Arthur J. Foley will continue in charge as the Neilan Chicago representative.

This office will also be occupied by the Mason Regulator Company (the parent company of the Neilan Company). Mr. William P. Gearon represents the Mason Company. The new telephone number is Midway 10221.

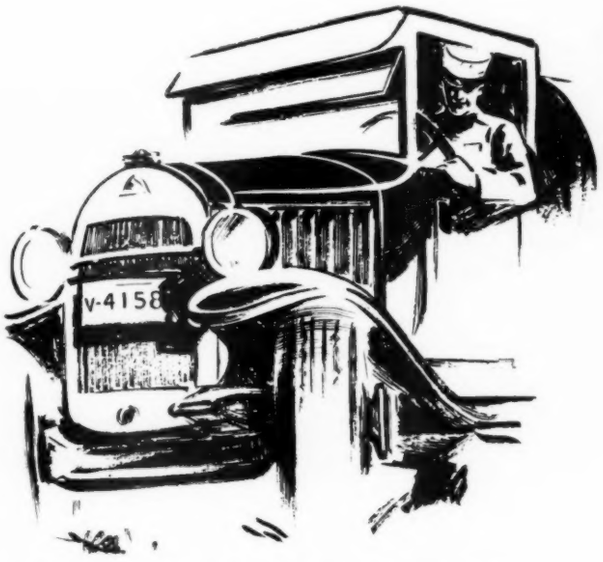
STRANGE . . . *but* TRUE

HAPPENINGS IN THE PETROLEUM INDUSTRY

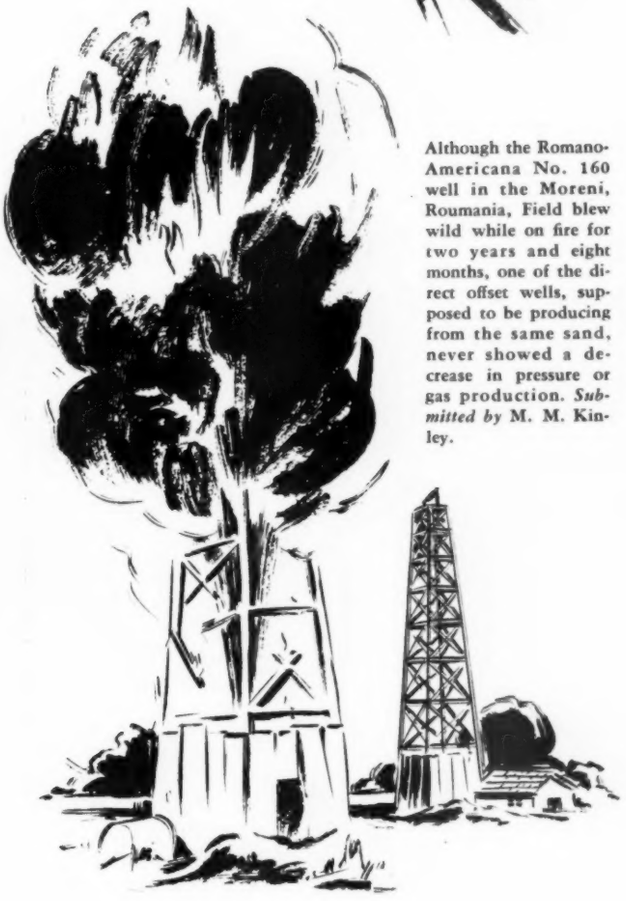


The total production of oil since the Drake well was drilled is still short of a cubic mile in volume, and less than the weight of material blown into the atmosphere during the two days of volcanic eruption of Krakatoa, April 26-28, 1883.

The bridge over the railway on Willow Street in the Signal Hill field carries 41 pipe lines—24 along one side and 17 on the other—ranging from two-inch diameter up to 12-inch. Some belong to the City of Long Beach, some to major oil companies, some to independents; carrying oil, gasoline, gas, vacuum, waste water, drinking water, etc. Many of them have owner's telephone numbers and other distinguishing marks. *Submitted by* Frank Mason, with Alexander Anderson, Fullerton, Calif.



Pure Oil Company's Truck No. V-4158, Van Field, in the second year of its service had been driven 22,222 miles at 2:00 P. M. on the 22nd day of the 2nd month of the year 1932.



Although the Romano-Americana No. 160 well in the Moreni, Roumania, Field blew wild while on fire for two years and eight months, one of the direct offset wells, supposed to be producing from the same sand, never showed a decrease in pressure or gas production. *Submitted by* M. M. Kinley.

HERCULES GASOLINE CO.

California Refinery
FOR SALE

This complete refining unit is available for immediate operation and offers an unusual opportunity for an organization contemplating establishment in Los Angeles territory or expansion of local facilities.

Situated on seven acres at 30th street and Santa Fe Avenue, Vernon, (Los Angeles) Calif.

Eight Distillation Units and Jenkins Cracking Unit. Real Estate has been appraised at $153,000, is clear and owned in fee by Company. Most desirable industrial tract in Vernon. Santa Fe and Southern Pacific Railroad tracks to property. 250,000 barrels storage facilities. Complete Foamite Fire Protection.

Inspection by Appointment. Complete Technical Description of Plant and Equipment Available Upon Request.

HUBERT F. LAUGHARN
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633 Subway Terminal Building
LOS ANGELES Mutual 2248 CALIFORNIA

Wm. J. Morris Elected President of Continental Supply

William J. Morris

William J. Morris, formerly financial vice-president of the Youngstown Sheet & Tube Company, has been elected president of the Continental Supply Company, St. Louis, Mo., a subsidiary of the former concern. The Continental Company handles distribution of oil country pipe and field supplies through scores of stores throughout the country.

Mr. Morris will leave at once for St. Louis to take up his new duties. He became connected with the Sheet & Tube Company in 1906; was its treasurer from 1922 to 1925, and has been a vice-president of the company since April, 1925. Mr. Morris' position as financial vice-president of the Youngstown Sheet & Tube Company will not be filled immediately. He will succeed H. B. Gutelius, who resigned some time ago.

The Continental Supply Company is selling oil country goods, machinery and equipment throughout the Mid-Continent and Southwest fields. Its principal office is at St. Louis. It is one of the most important subsidiaries of Youngstown Sheet & Tube Company.

H. B. Owens Dies

H. B. Owens, supervisor of industrial sales for the Caterpillar Tractor Company, and a well known personage in the pipe line industry of the United States, passed away at his home in Peoria, Ill. His death occurred after a short illness from pneumonia. Mr. Owens was at one time farm boss for the Empire Oil & Gas Company in the Smackover, Ark., field.

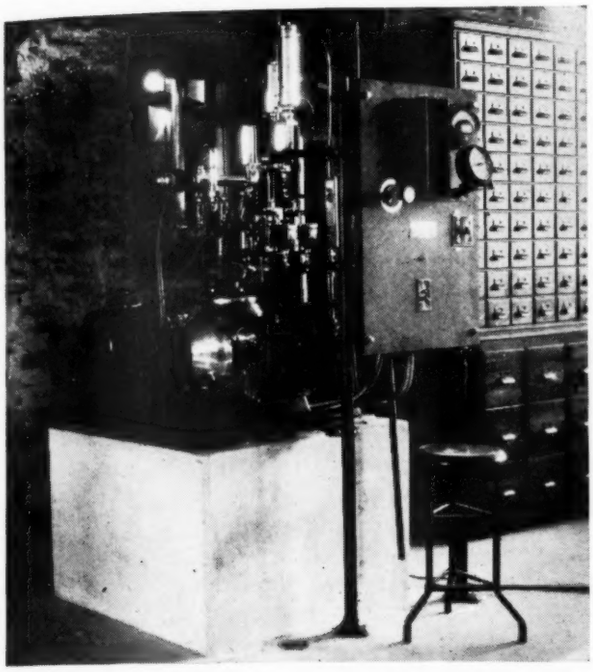
Correction

The Octane Oil Refining Company, Baird, Texas, is operating a combination skimming and reducing unit which is covered by patents applied for by Sylvester Dayson, president. The Donnelly Process is not used. This is to correct a statement in our June issue.

Greene Bros. Move to Dallas

Greene Bros., Inc., have removed their headquarters from Wichita Falls, Texas, and established their main office and warehouse at 1812 Griffin, Dallas, Texas. The jobbing firm handles pipe line and refinery specialties, laboratory equipment, re-agents, heavy chemicals and scientific instruments. A branch office is maintained in Wichita Falls.

Series 30-B Knock Testing Unit at Tulsa University



Ethyl Gasoline Corporation Series 30-B Anti-knock Testing Unit

THE petroleum research department of the University of Tulsa, Tulsa, Okla., recently installed one of the latest type series 30-B anti-knock testing engines built by the Ethyl Gasoline Corporation. It can be operated at speeds from 600 to 900 r.p.m. and at temperatures from 212 degrees F. to 362 degrees F. The engineering school is now equipped to carry on research work on motor fuels, and to instruct the students of petroleum refining in the procedure of determining the octane rating of gasolines. Refiners and marketers in the Mid-Continent area will have available a central testing and research laboratory to work on any problems which they may choose to submit. Doctor Sidney Born is in charge of the research department, and W. L. Nelson is professor of petroleum refining.

The laboratories of the university are equipped with the most modern apparatus for conducting petroleum research work. The flash vaporization equipment installed in one of the laboratories is useful to duplicate pipe still operation. From the data obtained on this apparatus the operating requirements for pipe still heaters and fractionating towers can be accurately calculated.

A true boiling point unit is installed for conducting detailed analyses on any crude or distillate. It can be operated under atmospheric pressure or under a high vacuum for carrying on the complete distillation of a crude including the heavy lubricating stock and wax distillate. Accurate information on the various fractions of the crude can thus be determined. This apparatus was designed from actual engineering experience gained in the design of commercial refinery units. By means of the two units complete evaluation of any crude oil or petroleum distillate can be made.

The co-operative system of education is used in the engineering school of Tulsa University. The Texas Company, the Empire Oil & Refining Company, the Mid-Continent Petroleum Corporation, and the Superior Oil Company cooperate with the university in this work. The course is of five years' duration.

Your Money's Worth

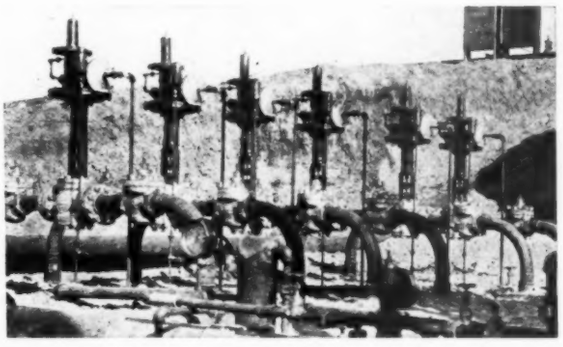
In times like these it's easy to mistake the *price of a controller* for the *cost of control.*

They are different.

It's *results* you are after—precise, trouble-free control. A controller bought on price may give you results. It may not. And until it is installed—until the production and profit of your plant are actually at stake, you can't be sure.

You *can* be sure when you buy your results right at the start—when you specify Neilan equipment for automatic control applications. To assure those results for you, the Neilan Company continues to spend thousands of dollars each year in research and development; continues to build Neilan control equipment in the best possible way.

Neilan controllers are sold at prices in line with the values built into them. To get your money's worth, specify Neilan.



"MUST"

In isolated installations, like these in the Kettleman Hills, control equipment MUST hold the pressure precisely and they MUST be reliable. It is in meeting MUST conditions of this type that Neilan's rigid manufacturing standards and pre-installation trial-runs prove their worth.

For example, many so-called stainless steels, while suitable for some services, have little corrosion resistance in the severe service so common in the oil and process industries. All parts which are subjected to wear and corrosion in the Neilan No. 47 Pilot Operated Back Pressure Regulators shown here are machined from Nirosta KA2 Stainless Steel *rolled bar stock*—not from castings. Result: maximum resistance to chemical action, freedom from physical defects and the dense grain structure so imperative for withstanding erosion effect of high velocities.

NEILAN CO., Ltd.

[DIVISION OF MASON REGULATOR CO.]

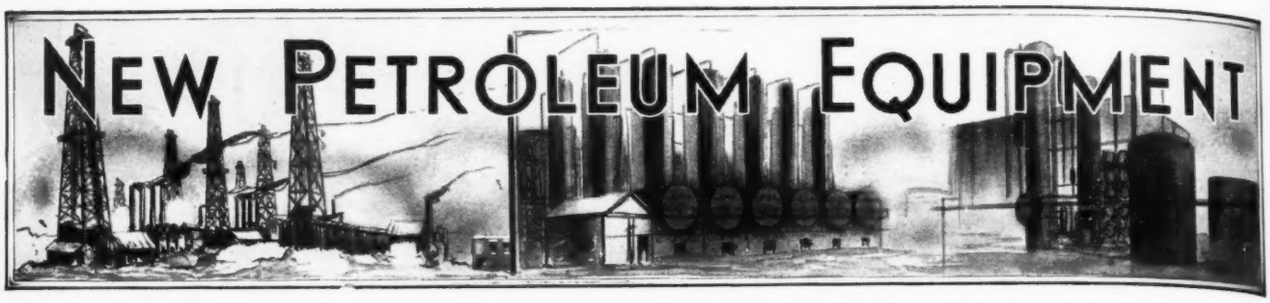
641-651 Santa Fe Avenue — Los Angeles, California, U. S. A.

NEW YORK, 19 Rector Street - - - - - - - - Rudolph B. Werey, Mgr.
CHICAGO, 1525 East 53rd Street - - - - - - - - Arthur J. Foley, Mgr.
PITTSBURGH, Clark Bldg. - - - - - - - - - - Bruce Irwin, Mgr.
BOSTON, 1190 Adams Street - - - - - - - - - Mason Regulator Co.
TOLEDO, OHIO, 1914 Vermont Avenue - - - - - - Frank Mason, Mgr.
TULSA, 409 East Archer Street - - - - - - - - Gordon Thomason, Mgr.
SAN FRANCISCO, CALIF., Mills Bldg. - - - - - - - Wm. T. Mayer, Mgr.
MONTREAL, CANADA, 686 Notre Dame St., W. - - - - - H. L. Peiler, Mgr.

REPRESENTATIVES

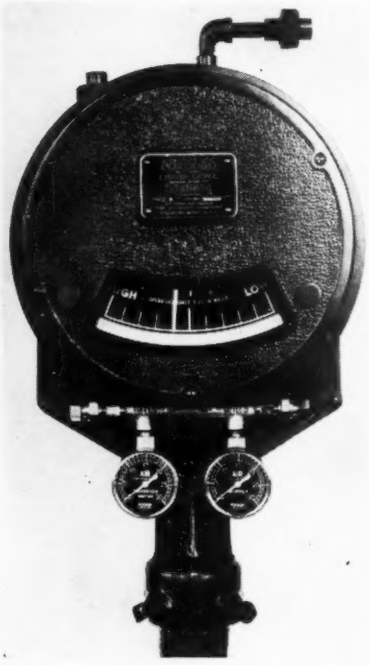
PHILADELPHIA, 930 North Front St., Baeuerle & Morris, Inc.
ST. LOUIS, 2726 Locust Blvd., O'Brien Equipment Co.
HOUSTON, 1400 Conti Street, Maintenance Engineering Corp.

"YOU CAN BE SURE OF NEILAN PRODUCTS"



Foxboro Liquid Level Stabilog

THE Liquid Level Stabilog, an unusual instrument designed especially for continuous process industries, is being introduced at this time by the Foxboro Company of Foxboro, Mass.



With the announcement of this instrument, the Foxboro Company states the Liquid Level Stabilog positively prevents surges in flow, thereby permitting satisfactory control at critical points in any process. The instrument is made in two types:—throttling and averaging, which take care of any level problem.

The throttling type is used in processes where it is desirable to hold a close level and yet have a smooth throttling valve action that will not set up surges in the controlled flow. The level is held exactly on the line with the result that the outflow is the same as the inflow. In some cases where a more uniform outflow is desired, the Stabilog may be adjusted so that the level is held only within fairly close limits.

The averaging type Stabilog allows the level to vary within safe limits, but holds the outflow as nearly uniform as possible. In this case the outflow averages out the variations in the inflow.

A more complete description of this instrument may be had by writing to the Foxboro Company for Bulletin No. 181.

Vertical Aerator Tower

THE Fluor Corporation, Ltd., Los Angeles, Calif., has designed a vertical aerator tower, for which the manufacturers claim advanced principles and new degrees of economy and efficiency.

The vertical aerators provide sufficient obstruction to air currents to cause them to follow a tortuous path during their course through the panel. The changes of direction, so enforced, knock out or separate the water particles from the air. From the top down, each aerator section is stepped out, insuring that the water will drop back into the tower, inside the aerator section directly below and upon a deck.

The structural design of this new Fluor tower affords great strength. In addition to sturdy framework, greater strength is secured from the tapered construction or widening from top to bottom.

Trackson-Highway Pipe Layer

THE Trackson-Highway Pipe Layer is a new high-capacity pipe boom for the Model GH Trackson McCormick-Deering crawler-tractor. This new unit, a side boom of the live type, is now being manufactured by the Highway Trailer Company of Edgerton, Wis.

Its development is the result of much field research and the active co-operation of many leading pipe line contractors.

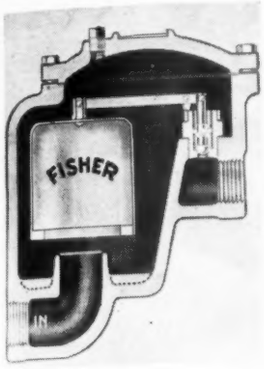
The ruggedness and compactness of this new combination is an outstanding feature; narrow right-of-ways and close quarters are no obstacles to its efficient performance. It has no protruding parts to snag branches or underbrush. The counterweights are placed effectively without being obstructive.

Lifting capacity is ample for the larger sizes of pipe. Without stiffleg, and with the load two feet out from the traetor, the lifting capacity is 19,875 pounds. Both boom winch and lifting winch have worm and worm gear drive (29-1), with the very desirable safety feature of lowering under power. Power take-off is a heavy-duty type and provides two speeds forward (low, .48-1, high 1.1) and one reserve (1.1). All castings, including the worm gear housings, drums and support hanger, are made of electric steel. The whole boom and frame assembly is hot riveted and electric welded. Bolts are used only where disassembly may become necessary.

Fisher Class ST Inverted Bucket Steam Trap

THE Fisher Class ST Trap is the result of more than two years' development in the Fisher research laboratories.

Features, such as the adjustable valve post, positively-guided inner valve, have been perfected and are a part of the Class ST trap.



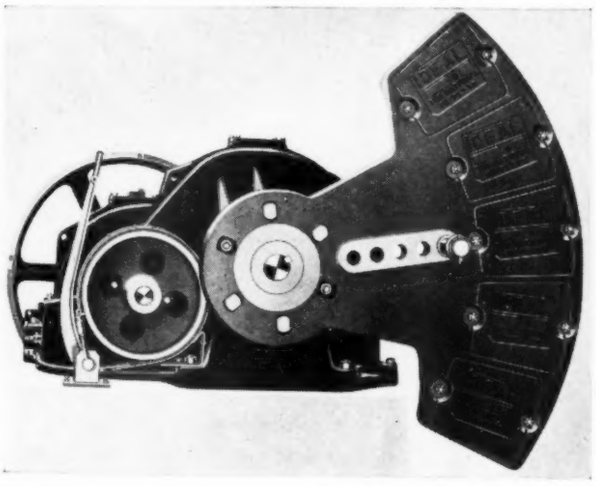
Outstanding construction features are: body and cover of semi-steel withrugged strength, inverted bucket of heavy gauge spun brass, lever and pins of stainless steel for maximum life. Valve and orifice seat are of the highest quality heat-treated stainless steel, resisting temperature, wire-drawing and corrosion. The guided inner valve insures positive seating. Valve post has special adjustment for ease of setting when replacing parts. The pipe connections are horizontal with vertical offset.

Upon removing trap cover, all parts are easily inspected or renewed. All parts are accessible and renewable while trap is connected in pipe line and no special arrangements are required to remove any of the parts.

The Fisher Governor Company, Marshalltown, Iowa, has just published a very attractive folder, known as Bulletin ST-10, covering this class of equipment.

Ideal Type F-3 Pumping Gear

THE National Supply Companies announce their new "Ideal" Type F-3 pumping gear. This is a single reduction gear unit with an additional stage of V-belt reduction



for driving a standard rig walking beam by means of a gas engine or electric motor.

A sprocket is provided for driving a production hoist, and a clutch within the gear unit permits the hoist to be driven independently of the crankshaft during pulling operations.

Crankshaft, intermediate shaft, gears and pin clutch are all mounted in a heavily ribbed and totally enclosed casing which permits all working parts to operate in a bath of oil. Crankshaft and pinion shaft are heat-treated alloy forgings, turned and ground, and are mounted on two Hyatt roller bearings. According to the makers these bearing capacities give a large factor of safety on the loads imposed, insuring the operator against bearing trouble and short bearing life.

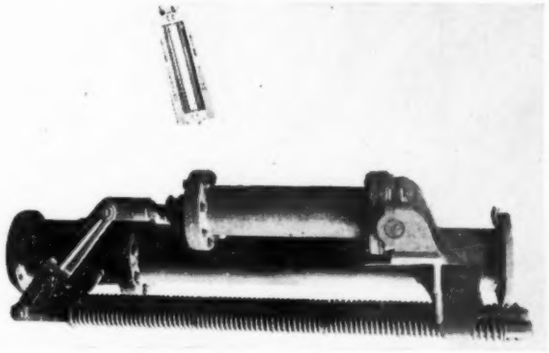
Type F-3 Gears are precision-cut, wide-faced, full-depth, involute spurs, produced by National's own Sykes gear generator. The gear ratio is conservatively low and the gearing is so designed as to give the unusually large capacity of 50 horsepower at 20 strokes per minute. Gears do not operate during pulling operations, being disconnected by means of a special type pin clutch easily operated by a lever on the rear of the frame.

The counterweighted crank provides a dynamic counterbalancing of the well load and acts not only as a counterweight but also as an energy storing flywheel. Five weight pockets, into which the weights are securely bolted, permits varying the counterbalancing effect. Instead of being keyed directly to the crankshaft, the crank is bolted to a spider which, in turn, is keyed to the shaft. This construction has the advantage of allowing a change in the position of the crank to distribute wear on the main gear.

The same unit, without the provision for driving a hoist, and known as Type F-4, is also available.

Steam Operated Automatic Shut-off Valve

A STEAM operated automatic shut-off valve has been developed for flue gas systems and for use on tanks. This valve, which is placed in the flue gas line, automatically



closes if either cooling water or steam ejector fails. The use of such a valve, according to the manufacturers, assures the proper functioning of the system, and is an added factor of safety—being an effective preventive of fire hazard.

This shut-off valve has been developed by Shand & Jurs Co., Berkeley, Calif. The accompanying illustration also shows an S & J manometer for use in refineries and particularly on tanks in connection with flue gas systems. This manometer is made of non-corrosive material.

Buckeye 7/16 Yard Convertible Shovel

A NEW 7/16-yard Buckeye convertible shovel has just been announced by The Buckeye Traction Ditcher Company, Findlay, Ohio. One of the features of this new shovel is the patented spring-stop shock absorber, which is said to entirely eliminate swing clutch slippage and shock to relative parts at the moment of reversing.

In this Buckeye shovel the ring gear is free to rotate against spring pressure through a slight angle in either direction, the kinetic energy of the swinging shovel base is overcome with but a fraction of this strain being transmitted to the clutch and gears.

The shovel has full-length alligator traction units controlled independently by two reversing clutches and independent brakes provide perfect maneuverability. Ground pressure of less than 10 pounds per square inch on the treads permits it to safely cover soft ground. The machine travels and is easily steered with the rotating base in any direction.

AMERICAN STEEL & WIRE COMPANY
The TIGER TRADE MARK is a symbol of Strength and Dependability
THE MARK FOR GENUINE AMERICAN WIRE ROPE

AMERICAN STEEL & WIRE COMPANY WIRE LINES

Dominating Wire Line Service

When oil-field operators think of wire lines they think of American Wire Lines—so well known is the constant dependability of rotary drilling lines and other lines made by the American Steel & Wire Company. In this field—where failures are very disastrous—operators take no chances but specify the product which most users have found best. Consultation with our experienced engineers will undoubtedly uncover for you methods that will decrease your wire line costs.

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208 South LaSalle Street, Chicago — SUBSIDIARY OF UNITED STATES STEEL CORPORATION — And All Principal Cities

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M-S-A Combustible Gas Indicator

THE M-S-A Combustible Gas Indicator, a new device for testing explosive gas hazards, has been developed and placed on the market by the Mine Safety Appliances Co., Pittsburgh, Pa.

The instrument will show whether the atmosphere under test is below the lower explosive limit, at the same time indicating how near it is to being explosive. It will also show whether the atmosphere under test is within the explosive range; that is, if it is an explosive mixture, and whether the atmosphere is above the upper explosive limit. These tests can be made in a few seconds time.

The device may be used advantageously for testing gasoline and oil storage tanks, oil tankers, manholes and along pipe lines, flammable liquid storage vats, etc. It is light in weight, easily operated and offers direct reading features. By squeezing the aspirator bulb a sample from any desired location is drawn rapidly through the flexible metal tubing to the instrument. Up to sixty feet of sampling line can be used with the indicator for sampling from inaccessible places. There is no lag in the indicator reading except the time required to draw the sample through the length of sampling line used.

The Mine Safety Appliances Company has published Bulletin No. 72, describing the new gas indicator. This bulletin will be forwarded to anyone desiring a copy.

Wagner Capacitor Motors

SUPPLEMENTING its other lines of single-phase motors, Wagner Electric Corporation, 6408 Plymouth Ave., St. Louis, Mo., offers a line of capacitor motors, known as type RZH. They are condenser-start condenser-run split-phase motors, the condenser capacity varied from start to run by means of a switch and an auto-transformer.

During starting, the main winding is across the line, one side of the auxiliary winding is connected to one side of the line, and the other side of the auxiliary winding has the switch and the primary of the auto-transformer. The condenser is connected across the secondary of the auto-transformer. The ratio of the transformation is such that a comparatively high voltage is placed on the condenser, giving higher capacity effect for starting.

In appearance they differ from other Wagner motors in that a box is mounted as an integral part on top of the motor to accommodate the condenser and auto-transformer. They are available as rigid-mounted or rubber-mounted motors, drip-proof or totally enclosed. They are completely described in Wagner Bulletin 167, Part 6.

Caterpillar Gear Sealing Process

THE Engineering Research Department of Caterpillar Tractor Co., Peoria, Illinois, has perfected, and the company now has placed in production, a gear-sealing process to protect the drive gear in the rear end of the tractor from dust, mud and grit.

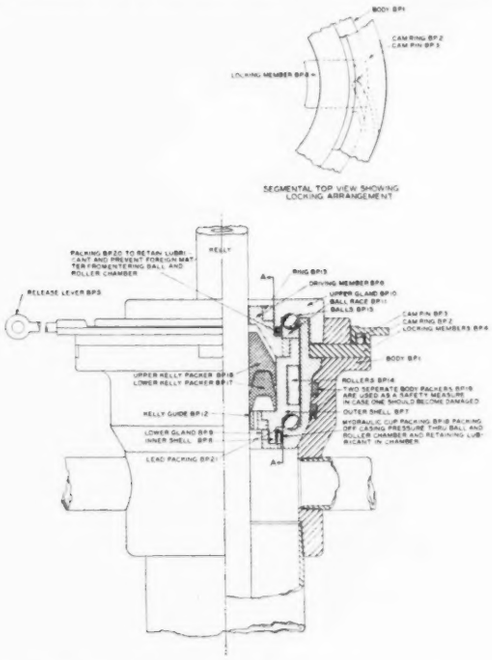
The process, for which a patent has been applied, accomplishes a dual purpose of sealing oil in gears and keeping dirt out, through a combination of hardened washers and spring-loaded cork gear housing. The process is being used on most of the new tractor models now in production.

"A combination of hardened and chrome-plated washers, spring-loaded sylphon bellows and cork facings," is the way H. T. McDonald of "Caterpillar's" engineering staff describes the new seal.

Automatic Rotating Blowout Preventer

THE MacClatchie Manufacturing Company, Compton, Calif., has perfected the MacClatchie automatic rotating blowout preventer. It is equipped with automatic packing, which the manufacturer states is subjected to but little wear when not exposed to pressure and can wear considerably and still hold easily any pressure encountered in present day drilling. There is no necessity of tightening packing gland due to the automatic packing feature. The packer is latched or unlatched by a rope running up to the derrick floor which makes it fast and easy to operate and eliminates the necessity of the crew going into the cellar for this purpose.

A cam ring is free to slide on the body and operates the locking members which hold the packer in the body. The



locking members (of which there are four) slide through slots in the body. They are actuated by a stationary pin which engages slots in the cam ring. Movement of the cam ring either forces these members in or out of the slots.

The swivel in the packer rotates on the lower ball race. When rotating under pressure the upper ball race carries the load. The lateral thrust is carried by the large rollers which surround the swivel. These three anti-friction bearings eliminate undue wear and allow the swivel to rotate with minimum friction. All parts are heat treated, hardened or ground and the complete assembles are tested to 4000 pounds cold water pressure under rotation before being shipped.

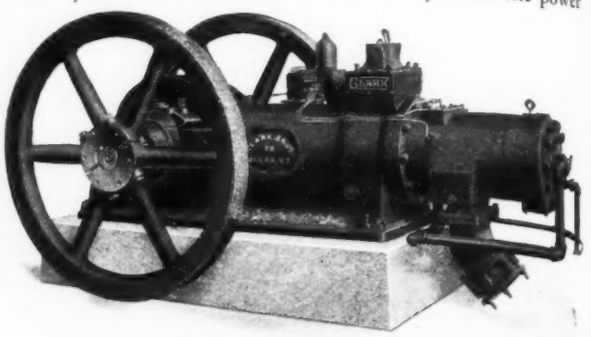
Clark Convertible 40-Horsepower Engine

CLARK BROS. COMPANY, Olean, N. Y., has developed a high compression, full Diesel oil engine, which is convertible to the use of natural gas. This engine, known as Model PC-40, is rated at 40 brake horsepower at 180 r. p. m., and is of the two cycle type.

While the Clark Model PC-40 engine can easily be arranged to use natural gas entirely satisfactorily and efficiently, it is designed primarily as a high compression, full Diesel oil engine and has the large shaft and the large pins of modern Diesel engineering practice so that bearing pressures are not excessive and there is no engine shaft deflection. The engine has a crank pin 7¼-inches in diameter and the crank shaft is 6½-inches in diameter at its two bearings.

The engine is self-lubricating and will run continuously with little attention. There are two separate overspeed safety stops, one at the governor and one at the crank shaft end of the pump push rod.

This model engine can have a bed arranged for a compressor cylinder at the end of the bed away from the power



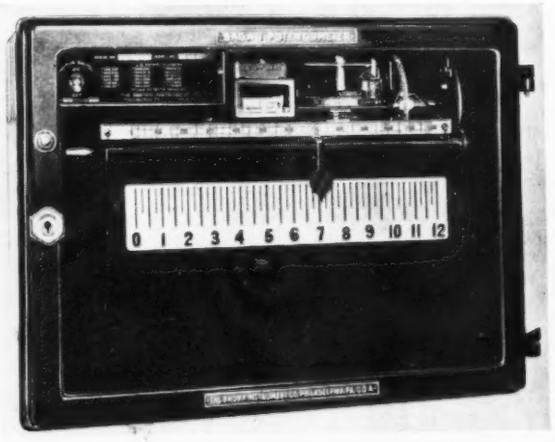
cylinder; for use as a gas or air compressor or as a combination power unit, that is, as a compressor and the engine also having a clutch and shaft extension to drive a water pump or other machinery.

When used as a gas engine, the fuel injection pump of the oil engine is replaced by a gas controlling valve operated by the governor and a magneto and spark plug ignition is used, also a different cylinder head is necessary.

Bulletin No. 200-54 fully describes this engine, and also contains interesting information and tables on fuel consumption, horsepower, etc.

Self-Balancing Indicating Potentiometer

A NEW indicating potentiometer of the self-balancing type is the latest addition to the potentiometer line of The Brown Instrument Company, Philadelphia, Pa. In addition to the main design feature of self-balancing, the new Brown indicating potentiometer has an unusually long (40-inch) slide wire, positive spiral shaft drive, a non-slip clutch, a secondary pointer definitely fixing the size of step in moving the slide wire contact, interchangeable case for universal mounting, mechanism swings out of case for easy inspection without interference with operation, mercury-in-glass switches in control models, automatic thermal equalization between cold junction terminals and compensation coil and many other construction and operating features of interest.

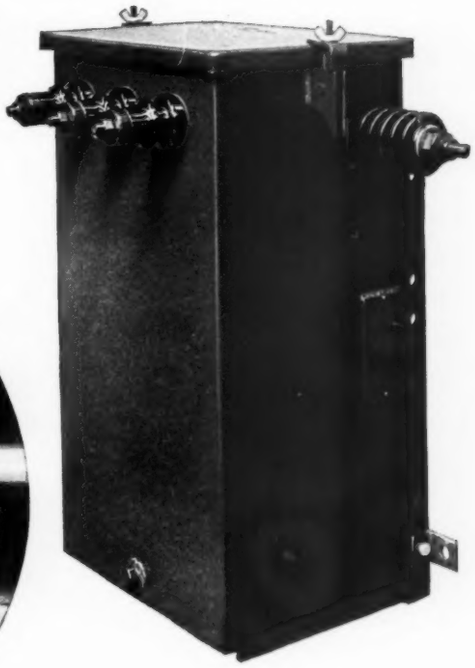


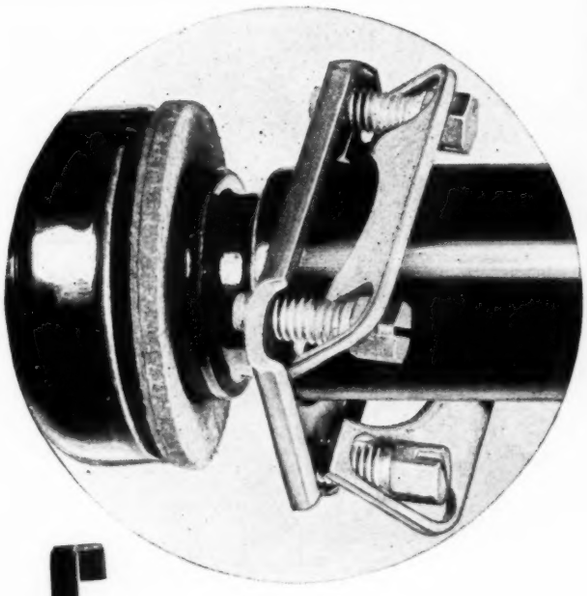
As a pyrometer this instrument can be supplied for any range from 0 to 100 degrees F. up to 0 to 3,000 degrees F., or for almost any span between these ranges. Models for automatically controlling as well as indicating temperatures can be furnished where specified.

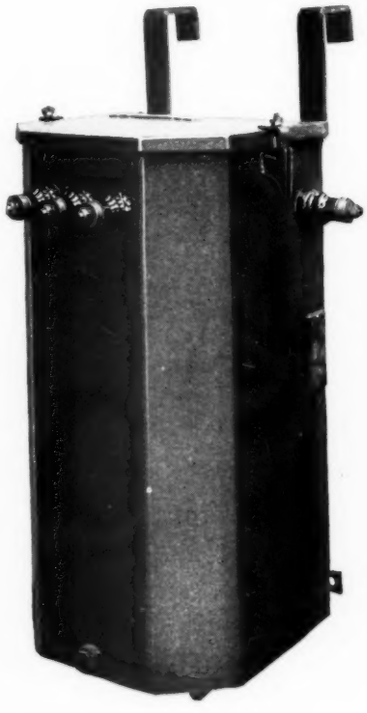
Stud-type transformers

built by Wagner **are equipped with a type of stud and bushing that can be quickly installed, or removed in the event of bushing failure . . . without fuss . . . without splicing cable leads . . . without lowering the transformers from platforms or poles. All that's necessary is a screw-driver to loosen four set-screws . . . plus a wrench to disconnect the cables. Thus they**

reduce installation and maintenance costs, economies always welcomed by central station operators







The bushing clamping assembly consists of two clamps, a retainer and four set-screws. The two clamps engage a groove in the bushing and are held inside the retainer when pressure is applied on the set-screws against the tank wall.

It is a very simple matter to loosen this clamping assembly and thus permit removal of the bushing: (1) loosen the screws — do not remove them completely; (2) part the clamps far enough to clear the bushing; (3) slip the entire assembly off the bushing; (4) slip the bushing thru the opening.

It's done in a jiffy—and all that's required is a screw-driver to loosen the screws . . plus a wrench to remove the transformer cable.

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, U.S.A.

MOTORS TRANSFORMERS FANS BRAKES

T-332-1

Factors in the Computation of Heat Balances

By W. L. NELSON☆

UPON first inspection the computation of heat (energy) and material balance seems so simple that often the engineer commits errors and fails to recognize them. A thorough understanding of the Law of Conservation of energy (First Law of Thermodynamics) helps to eliminate these errors. Sometimes they are of a small magnitude and may properly be neglected, but in a detailed study of the heating of a complex material like petroleum oils the errors may be relatively important.

Law of Conservation of Energy

The First Law of Thermodynamics postulates that "Energy may undergo change in form but not in amount." In applying this law it is of importance to gain the conception that the total energy content of a system (be it a pound of oil, a cu. ft. of vapor, a volume of metal, etc.) at a fixed set of conditions such as temperature, pressure, etc., is a constant. For example, the total internal energy content of one pound of pure water at 60° F. and at 14.7 lb./sq. in. pressure, containing no kinetic energy of motion, under the effect of the force of gravity at the earth's surface, etc., is always the same regardless of where the water came from, from what it was produced or what it may be used for. It follows that the difference in energy content of a system between two fixed sets of conditions is also a constant and that the processing steps by which the system is changed from one set of conditions to the other, are not important. The difference in energy content depends only upon the initial and final states of the system, and cannot be affected by the sequence of steps by which the change is effected. Of course it behooves the computator to assure himself that no energy changes are neglected unless they are of small magnitude.

Vaporization

The vaporization of petroleum oils is seldom conducted at atmospheric pressure although most designers use the atmospheric latent heats for all cases and all conditions of vaporization. Even in a fractionating tower operating at a gage pressure of only a few pounds, the vaporization of products may be taking place as if at pressures below atmospheric pressure due to the partial pressure effect of other products. The above law may be applied directly to the computation of latent heats at pressures other than atmospheric. Let us compute the latent heat of a 43 A.P.I. kerosene product at a pressure of 100 pounds per square inch gage pressure. The molecular weight of the kerosene is 200 and the latent atmospheric pressure is 80 B. T. U. per pound. The average or 50 percentage boiling point at atmospheric pressure is 518° F. and at 100 pounds gage is 710° F.

System: One Pound of Kerosene

One pound of liquid kerosene is to be vaporized at a pressure of 100 pounds per square inch and at a constant temperature of 710° F. Since the latent heat is known under atmospheric conditions, we will go through a series of steps bringing the system to atmospheric boiling point conditions by withdrawing energy from the system, adding energy by vaporizing at atmospheric conditions, adding energy into the system now vapor) by heating to 710° F. and withdrawing heat in compressing to 100 lb. per square inch. The following steps are necessary:

(1) Cool liquid from 710° to 518° F. at 100 lbs.

(2) Reduce pressure from 100 lbs. to 14.7 lbs. (negligible.) (3) Vaporize at 14.7 lbs. and 518° F.

(4) Heat vapors from 518° to 710° at 14.7 lbs.

(5) Isothermal compression from 14.7 lbs. to 100 lbs. at 710° F.

Computation

(1) 1 (518-710) 0.81	=	—15.5 B.T.U.
(3) 1 (+80)	=	+80.0
(4) 1 (710-518) 0.63	=	+12.1
(5) Compression	=	—23.9
Latent heat from and at 710° F.	=	52.7 B.T.U.

This value checks very well with the meager experimental data that is available and perhaps is even more accurate than most of these data.

Pipestill Heaters

Engineers are often confused in computing the heat that is added to an oil during its passage through a pipestill. The confusion arises because the vaporization at the outlet of the still cannot be easily computed and because vaporization occurs under a varying pressure. Nevertheless, by the First Law of Thermodynamics the heat input between the inlet temperature and the temperature of the oil after it has again reached atmospheric pressure (although at a higher temperature) is a constant. Let us compute the heat required to heat and vaporize one pound of 60 A.P.I. gasoline. It is available at 100° F. and the vapors leave at 500° F. According to this law the heat input should be a constant even though vaporization occurs at 250°, 300° or 350° F.

System: One Pound of Gasoline

	Vaporizing at °F	Sensible Heat of Liquid		Latent Heat		Sensible Heat of Vapor		Total Heat
(1)	250	(250-100) 0.567	+	110	+	(500-250) 0.53	=	336.5
(2)	300	(300-100) 0.585	+	113	+	(500-300) 0.541	=	338.3
(3)	350	(350-100) 0.60	+	107	+	(500-350) 0.554	=	340.0

This slight discrepancy of +2 B.T.U. may be explained by recalling that vaporization at 250° F. occurs at a lower pressure than at 300° F. and vaporization at 350° F. occurs at a higher pressure. Hence in Case (1) an additional small amount of energy would have to be supplied in order to compress the gas to atmospheric pressure and in Case (3) energy would leave the system upon expansion.

From the above example calculation it is apparent that the heat absorbed in a pipestill which feeds into a tower at substantially atmospheric pressure may be determined by computing the heat required to heat each of the products entering the still to its average atmospheric boiling point, vaporizing using atmospheric latent heats and superheating the vapors at atmospheric pressure to the temperature of the material in the feed section of the tower. If the tower pressure is far above atmospheric pressure an additional heat input (energy) would be required from the pipestill in order to isothermally compress each of the product vapors to the tower pressure.

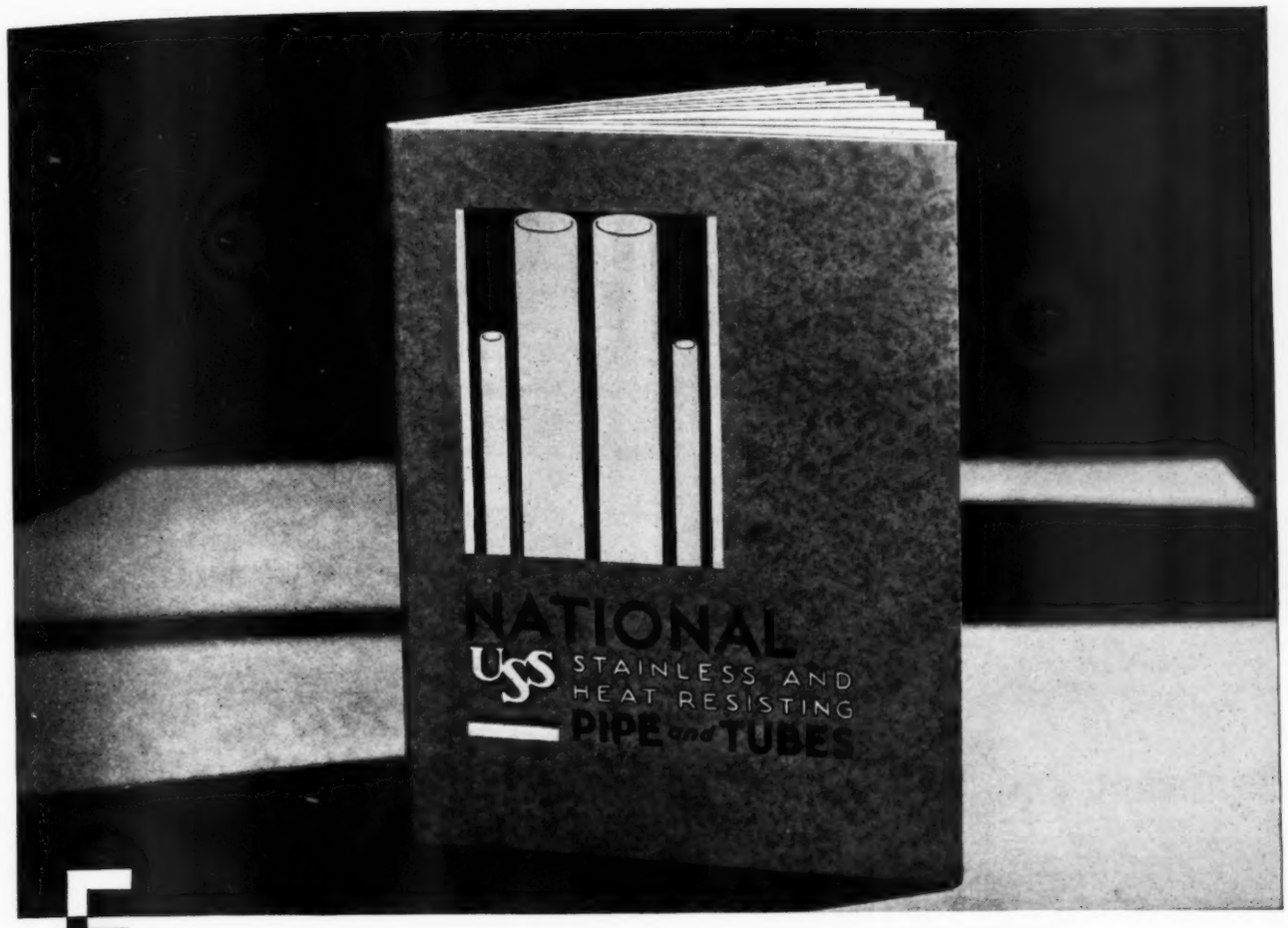
In a similar manner the First Law of Thermodynamics may be applied to the solution of a number of troublesome problems. As examples, the following is a list of problems which may be solved by the same reasoning as above:

(1) Heats of Combustion at other temperatures than 60° F.

(2) Converting heats of cracking (reaction) from one temperature to another.

(3) Converting heats of fusion from one temperature (or pressure) to another.

☆Head of the Department of Refining Engineering, University of Tulsa, Tulsa, Oklahoma.



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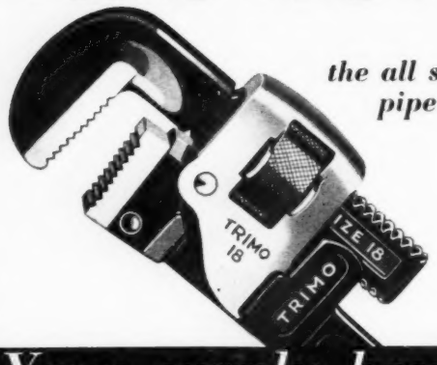

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LEAD soaps can be made from most any kind of an animal or vegetable oil, beeswax, rosin, etc.; in fact, anything which is saponifiable, but only a few of these lead soaps have gained any practical value.

Lead linoleate has been used extensively for years in the paint industry as a drier in the manufacture of boiled oils and varnishes. Lead oleate, known as "lead plaster," is much used in pharmacy.

During the last few years lead soaps have entered another field of practical use, namely, that of lubrication.

With the advent of newer designs in modern motor car transmissions and differentials, it had become necessary to develop a more efficient gear lubricant, which embodies slightly different characteristics than any of the other transmission greases heretofore manufactured. The result has been that lead soap base gear compounds were perfected to meet this demand. In appearance these lead greases resemble a straight transmission oil and are essentially different from the stringy and fibrous nature of the soda base class, in as much as they are smooth, free flowing and very unctous. They produce a more stable lubricating film—they more effectively reduce friction and they resist the scraping and squeezing action of the gears in the modern high speed transmission and differential assembly.

Lead soaps are manufactured by one of two methods:

(1) Process of double decomposition.

(2) Process of fusion (known as high temperature process).

The first process is rather complicated and expensive for practical use and is mostly employed where a comparatively pure lead soap is required. It is prepared by first saponifying the fatty oil with caustic soda solution. The soda soap which is formed is dissolved in a large amount of water and lead acetate solution added to it, in order to convert it into lead soap which is insoluble in water. This lead soap is washed several times with boiling water in order to free it from sodium salts and is then dehydrated by heating at about 250 degrees Fahrenheit.

For example, in manufacturing lead oleate the following procedure can be employed:

Saponify 100 parts of oleic acid with 15 parts of caustic soda (100 per cent). The caustic soda should be used as a 25-30 Baume solution. Heat the ingredients in order to facilitate the neutralization. A slight excess of alkali should be present after saponifation is completed. The sodium oleate is dissolved in about 1500 parts of water and while boiling 65 parts of lead acetate, dissolved in about 500 parts of water are added, whereupon a heavy precipitate of lead oleate is formed. This precipitate is washed with boiling water and dried as mentioned above.

Lead Soaps With Lubricants

T. SIEBER
averly Oil Works

The chemical reaction involved in this process can be expressed by the following equation:

1) R — COOH + NaOH = R — COONa + H2O

2) 2(R — COONa) + Pb (Ac)2= (R — COO)2 Pb. + 2 NaAc

Theoretically 100 pounds of saponifiable oil should produce 136 pounds of the corresponding lead soap, this efficiency however is never attained, by reason of the fact that variable losses result from the washing process. The yield is also effected by the completeness of the turnover of the soda soap into lead soap. This reaction at this stage is influenced for the most part by the proper concentration of alkali, and this suggests that too large or too small an excess of alkali be avoided.

The second process is the most commonly employed in manufacturing lead soaps for use in lubricants. This method is by far quicker than the first mentioned and the operation can be better and more easily controlled.

It consists in heating Litharge and fatty oil in a fine kettle to temperatures of approximately 500 degrees Fahrenheit. At this temperature the chemical reaction takes place with the liberation of water which is subsequently boiled off. The soap so obtained is a heavy, black mass of high consistency, which when cut back with a suitable mineral oil stock gives a transmission lubricant of the proper density.

The most commonly used fatty oils are fish oil, red oil (oleic acid) etc., in fact fatty oils of the unsaturated group are the most suitable raw materials for this type of soap manufacture.

Chemically the reaction takes place as follows:

2(R — COOH) + PbO = (R — COO)2 Pb. + H2O

Some manufacturers claim that the use of a lead soap, such as lead oleate or lead fishate, made by the fusion process, imparts a low cold test to the resulting lubricant. But the writer is not entirely satisfied with the general truth of this statement.

In making lead base greases, using the fusion process, it is always advisable to make a lead soap concentrate first and then dilute to the required consistency with mineral oil. By doing so it enables the manufacturer to turn out larger quantities of grease in a shorter time and to cut his manufacturing expenses to a minimum.

Lead base lubricants are preferred more or less by popular approval in that they apparently withstand greater pressures, do not channel, have greater fluidity and seemingly do not break down or ever wear out. For the future, we look forward to the development of new greases, possibly those combining and incorporating the desirable properties and characteristics of lead soap with other soaps, to produce something quite new in the way of lubricants.

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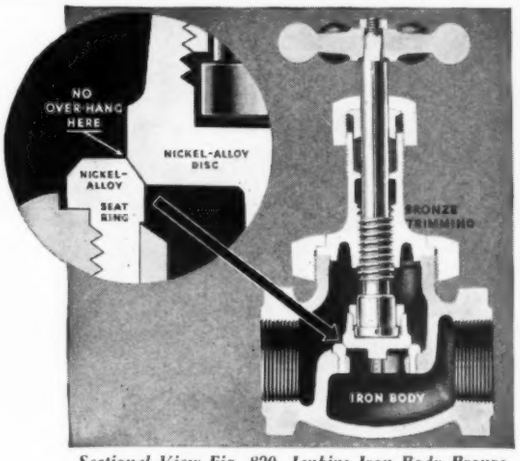

Sectional View Fig. 890, Jenkins Iron Body Bronze Trimmed Globe Valve, Regrinding, Union Bonnet; with renewable nickel alloy seat ring and disc.

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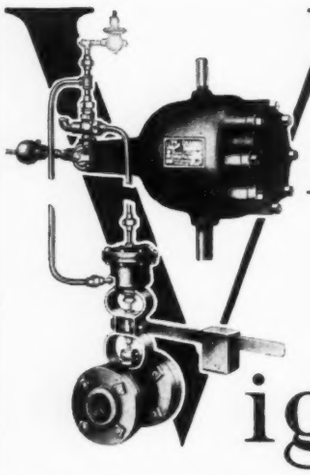

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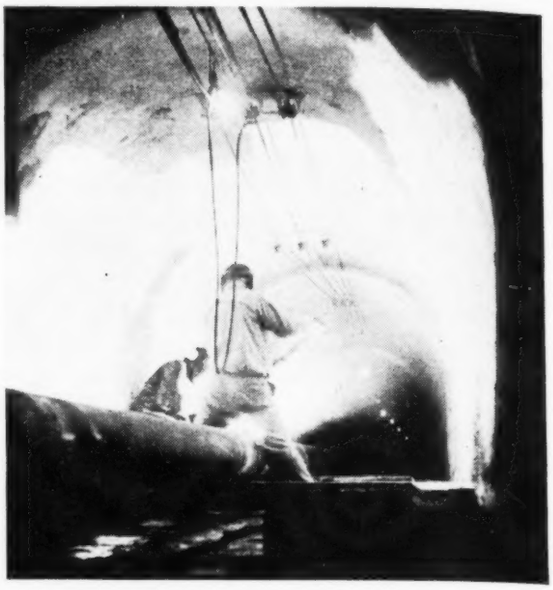
Oil Lines Cross Ship Channel in Tunnel

WHEN the War Department revised its clearances in the Houston Ship Channel last year three oil companies whose pipe lines crossed the channel were faced with the alternative of relocating the lines by dredging to meet



A Rolling Weld on the first pipe line in the tunnel

the new ruling or building a tunnel for the lines beneath the channel.

Tunneling was decided upon. The tunnel itself, an inverted U-shaped tube, is 12 ft. in diameter, 612 ft. long and is 87½ ft. below water level. Pipes enter and leave the horizontal tunnel by means of a vertical 10 ft. inside diameter shaft at each end.

The vertical concrete shafts with a wall thickness of 18 inches of reinforced concrete were built on the surface of the ground in 2 ft. sections. As each new section was added the others sank of their own weight.

To help this sinking the first section carried a cutting edge made of boiler plate and 4x4 angle. Excavating inside the shaft was done as the sections sank.

When the vertical shafts were completed pipes carrying grout at 100 lbs. pressure were inserted in holes in the shafts and pumping was continued until grout showed up on the surface outside the shaft. Suitable soil for the tunnel proper was found at 66 feet and work was carried forward from the south shaft, while the north shaft was being built. When the tunnel reached this it was found to be only 3 inches off center. The tunnel itself was excavated by compressed air spades, dirt being carried out in small cars. Cribbing was used and placed 12 inches outside the steel form which was used for the inside of the tunnel. Concrete was poured into this 12 inch space to form bottom, sides and top of the tunnel. Suitable concrete supports were placed in position throughout the tunnel to accommodate the ten oil lines which cross the channel and which range in size from 8 to 12 inches in diameter. Pipe lengths were butt welded, using the shielded arc process with "Fleetweld" electrodes and "Stable Arc" welders manufactured by The Lincoln Electric Company, Cleveland, Ohio. Rolling welds were made. As each line was finished it was placed in position and tested with water at 800 pounds pressure. The finished lines were arranged in tiers in the tunnel and were held in place and to the concrete supports by hold down clamps. This was necessary because on completion of the lines the tunnel was flooded with fresh water to prevent corrosion, fire and explosion. This procedure also minimized contraction and expansion of the lines.

SCOUT'S 1932 YEAR BOOK—This book, published by the National Oil Scouts' Association of America, Dallas, Texas, is the association's second year book. It contains an unbiased presentation of the facts and figures collected by members of the organization in their respective districts during 1931. This includes production, geological, drilling and general history of all the fields in the state of Texas, southeastern New Mexico, Louisiana, Arkansas and Mississippi.

The first year book (1931) discussed the history of fields in this territory from their beginning to the first of 1931, while the 1932 book brings all of this information up to date, besides discussing all new fields opened and developed during the year 1931.

These books, published annually, are available without cost to all members of the association who have paid their annual dues of $5.00. Active membership is limited to those connected with the scouting and land departments, but other oil men are permitted to become associated as inactive members and are entitled to the privilege of getting a copy of one of these fine books. For further information write John H. Langston, Sun Oil Company, Dallas, Texas.

VALVELESS AUTOMATIC CONTROLLERS for Atmosphere and Temperature in Oil Burning Furnaces are discussed in Bulletin No. 1010, published by the Johnston Manufacturing Company, Minneapolis, Minn. New features shown in this bulletin are the duplex units adapted for use on multiple burner furnaces, and the pneumatic remote control which permits locating the controller in any desired position in respect to the burner.

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FORTY YEARS—Since 1892 the Hyatt Roller Bearing Company has been manufacturing Hyatt Roller Bearings. The company has published a book called "40 Years" in commemoration of this important milestone in its history. This book is like a trip through the company's manufacturing plants, all steps in making and designing these bearings are illustrated and explained.

NICKEL STEEL TOPICS is the name of a new bimonthly paper devoted to the interests of users and fabricators of nickel alloy steels. It is being published by The International Nickel Company, Inc., 67 Wall Street, New York City. This concern wili be glad to place your name on the mailing list, if you are interested.

THE PROGRESS OF NAPHTHOLOGY, 1930-1931, is the subject matter discussed in a book published by The Institution of Petroleum Technologists, Aldine House, Bedford Street, Strand, London, England. Copies of these reports are obtainable from the above address at 10s. 6d. each.

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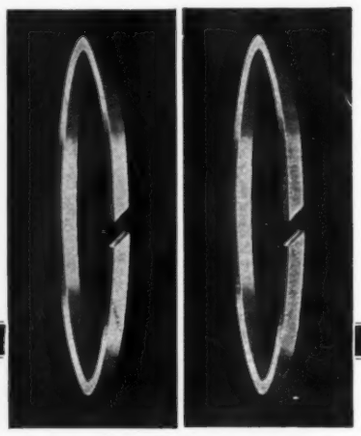

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NEW BOOKS—Continued

THE DIESEL CATERPILLAR TRACTOR'S history is given in a roto broadside being distributed by the Caterpillar Tractor Co., Peoria, Ill.

OIL FINANCES AT A GLANCE, by Alexander B. Morris, is a compilation of the 1931 annual reports of 27 leading American oil companies, analyzed on a comparable basis. This book, priced $3.00, is obtainable from the author, who may be addressed at 624 So. Boston Ave., Tulsa, Okla.

COMBUSTION ENGINEERING CORPORATION, 200 Madison Ave., New York, has available for distribution copies of three articles, namely, "Tangential Firing of Gaseous and Liquid Fuels," "Corner-Firing of Blast Furnace Gas" and "Combination Burning of Blast Furnace Gas and Pulverized Fuel." In this series of articles the author discusses the recent developments in methods of firing and in furnace design.

FOXBORO BULLETIN NO. 182, describing the new line of Potentiometer Control Pyrometers manufactured by the Wilson-Maculen Pyrometer Division of the Foxboro Company, Foxboro, Mass., are ready for distribution.

"A WONDER BOOK OF RUBBER" is the title of a new brochure on the rubber industry published by The B. F. Goodrich Company, Akron, Ohio. This is a story of rubber and the manufacture and use of rubber products.

High Temperature on Metals

The joint Research Committee on Effect of Temperature on the Properties of Metals announces plans for sponsored researches at the University of Illinois and the Batelle Memorial Institute. Funds made available by the American Petroleum Institute, the Engineering Foundation, the National Research Council, and others, have made it possible to initiate activities and to continue work throughout the present calendar year. It is the hope of the committee that additional funds will be made available.

The work at the University of Illinois will relate largely to the endurance properties of austenitic nickel-chromium steels at high temperatures. It will be co-ordinated with creep tests made at the Batelle Memorial Institute. The researches on cast and wrought carbon steels already under way will be continued.

Diphenyloxide Boiler

The Dow Chemical Company, Midland, Michigan, has installed an experimental boiler that will operate on diphenyloxide instead of water. It will be used to study the advantages of this compound as a heat transfer medium. The boiler will be fired by oil in a radiant heat-absorbing furnace. The oil burner is in the bottom of the furnace, which is square in cross section. The four walls are lined with coils through which there is a forced circulation of diphenyloxide by means of a centrifugal pump.

A fusion welded drum is used on the boiler. This drum was welded and completed in the shops of Foster Wheeler Corporation. All the welds appeared flawless when radiographed. The welds were stress relieved in an annealing furnace at 1150 degrees F.

Diphenyloxide has physical properties that make it ideal for a heat transfer medium. Under ordinary conditions it is a solid, and in commercial work it is usually mixed with diphenyl to keep it in liquid state at lower temperatures.

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Where there is a combination of sand, acid and lodestone—use *Resistex*.

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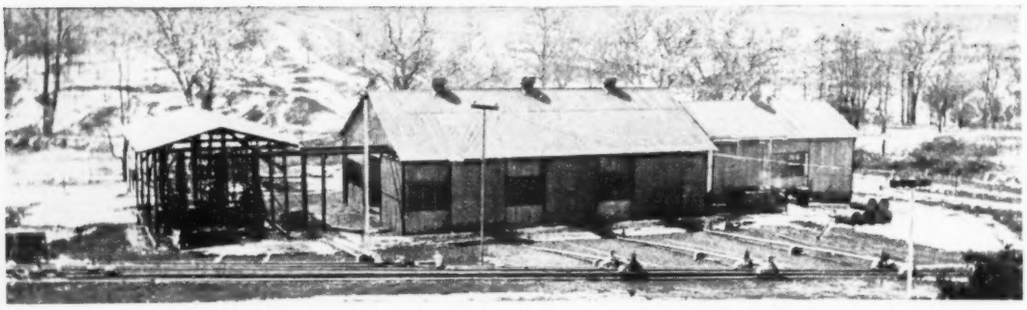


Repressuring Plant in the Garnett Shoe String Field.

Repressuring of Shallow Oil Sands Proving Profitable

By C. I. LAYTON☆

THE repressuring of depleted oil sands on a large scale was introduced three miles west of Lenapah, Okla., by I. L. Dunn of Tulsa, although the practice had previously proven a success in Ohio and Pennsylvania fields. A few of the "oil minds" of the country thought, however, that it would be unsuccessful here, hence a brief description of the property may be interesting.

It covered 360 acres of productive sand, on which were located seventy-five wells, producing a total combined output of thirty barrels of oil per day at the time the repressuring plant was installed. Although the entire property was down to thirty barrels production daily, it was found that, by obtaining the saturation and porosity of the sand only approximately 12.7 per cent of the oil had been recovered, leaving 87.3 per cent, or 5,400,000 barrels.

The property reached a peak of 311 barrels per day in less than a year after repressuring was commenced, and then settled to 150 barrels daily, pumping only three days a week. This project will be eight years old this fall and is still producing its 150 barrels, and it is believed capable of doing this for years to come. The lifting cost per barrel was well under 25 cents for the year 1931, and should be still lower for 1932.

A compressor plant, with a capacity of 900,000 cubic feet per twenty-four hours, was installed and started up in July, 1924. Within three weeks' time the production showed an increase and, by July, 1925, had reached ten times the original figure. Then the leases were put on a three-days-a-week pumping schedule and the production held down to 150 barrels per day.

☆Layton Oil Company, Garnett, Kansas.

Another fair example of a successful repressuring project is the Garnett Shoe String field, located two and one-half miles south of Garnett, Kansas. This pool is three and one-half miles in length and from one to four locations in width. It has an average sand thickness of thirty feet, with 270 productive acres having an estimated total oil reserve of 4,050,000 barrels.

The repressuring program here was started with a compressor plant, having a capacity of 500,000 cubic feet per day, and sixteen selected pressure wells. Repressuring was commenced when the field was in what would be termed a semi-flush condition, not all the wells having reached a settled basis. The express purpose of the project then was to try to maintain that condition. This was done, to a certain extent, but it was found that, by localizing the in-put volume in parts of the field, greater results could be obtained. This property was producing about 125 barrels per day before repressuring; of the sixty-eight producing wells, thirty are now averaging four barrels daily. Within a year after installation of the plant, the wells were making 248 barrels per day, and now, after six years, are producing 150 barrels of thirty-four gravity oil daily and give evidence of holding to this figure for years. Up to July, 1931, it is estimated that the field has produced 189,238 barrels of oil that could not have been produced had repressuring not been resorted to.

In order to obtain the maximum results on this property, it is necessary to hold a back pressure on some of the pumping wells to prevent by-passing through loose streaks in the producing sand, an action that if permitted causes cutting of the oil. A back pressure of from ten to seventy-five pounds is carried on the wells, depending on the volume coming through the sand and the amount of oil the well is producing. Back pressuring is accomplished by placing a small orifice in the casing head gas line at the well. The size of the orifice is such as to allow enough gas through to produce the most economical amount of oil. In fact, a gas-oil ratio has been established for each well. High pressure air costs three cents per 1,000 cubic feet to compress and deliver to the pressure wells, and it is not considered good policy to allow a pumping well to produce more than 2,000 feet of gas per barrel of produced oil.

Pumping Well No. 11, N. L. Bowman Farm. This well was producing one-half barrel before repressuring; is now making nine barrels a day, and has been doing this for the last five years.

The pumping wells are tested at regular intervals for air and CO_2 content. If they are making too much, we either insert a smaller orifice, or pinch the volume injected at the pressure well. A meter setting is placed at all pressure wells and a reading taken each week. We also take a "Prover" test of the compressors and an analysis of the air-gas discharge, the latter being necessary to eliminate explosive hazards. We are able to determine the amount of air going into the sand by making these various tests, and by subtracting the difference in the amount produced and recovered, are able to determine the amount left in the sand.

Pressure Well No. 2, showing a standard hook-up, where the tubing is cemented in. The choke or pinch valve is shown on top of the tubing

At the time the plant was installed there was scarcely enough casinghead gas to operate the property; however, it was connected up for gas, having a four-inch and a six-inch main line and two-inch lateral lines to all the wells. Every possible foot of gas was saved, with the result we now have enough gas to run the plant and the nine pumping powers, also enough partially to supply the compressors and we are repressuring one-half of the property with gas at this time. The gas coming from the field now shows on test only 35 per cent air content. This will be of unusual interest to operators who are contemplating repressuring properties where the casinghead gas has been depleted. It has been our experience on every successful property that the casinghead gas increase is comparable to the oil increase, and, in a short time, if care is exercised, sufficient quantities of gas will be had for operations and, generally speaking, for repressuring also.

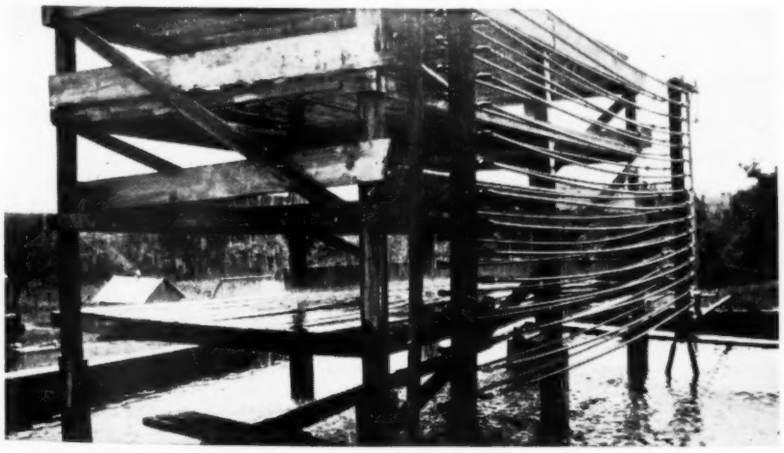
On the unit compressing gas a set of after coolers has been placed in the spray pond, and thus enough gasoline is extracted for the operation of the cars and trucks on the leases. The accumulation over this amount is returned to some of the pressure wells. It could be sold at a profit, as it is entirely a by-product, but we think that greater value is derived from it by returning to the wells.

In the Garnett Shoe String pool the pressure wells begin to silt over after a certain length of time, the face of the sand becoming covered with a greasy muck. Gasoline placed in the well under high pressure is very effective in removing this layer of muck. Should the wells silt up so that they will not take the desired volume of air or gas, it is often desirable to shoot them with a few sticks of dynamite.

The more successful pressure or intake wells are equipped with two-inch and two and one-half-inch tubing, cemented or. top of the oil sand. The tubing string is cemented to prevent repressuring a barren gas sand, which is usually found immediately above the oil sand. Repressuring of this barren gas sand is unprofitable and also promotes by-passing. Therefore, in shooting a pressure well, we employ sticks of dynamite tied together, using caps and a fuse of proper length, and lower them into the well on shooters' cord or an old measuring line. Heat action of the dynamite accompanies the blasting and tends to melt and blow away the silt and muck from the face of the sands. The material removed falls to the shot hole. We have used as many as ten sticks without injury to the tubing.

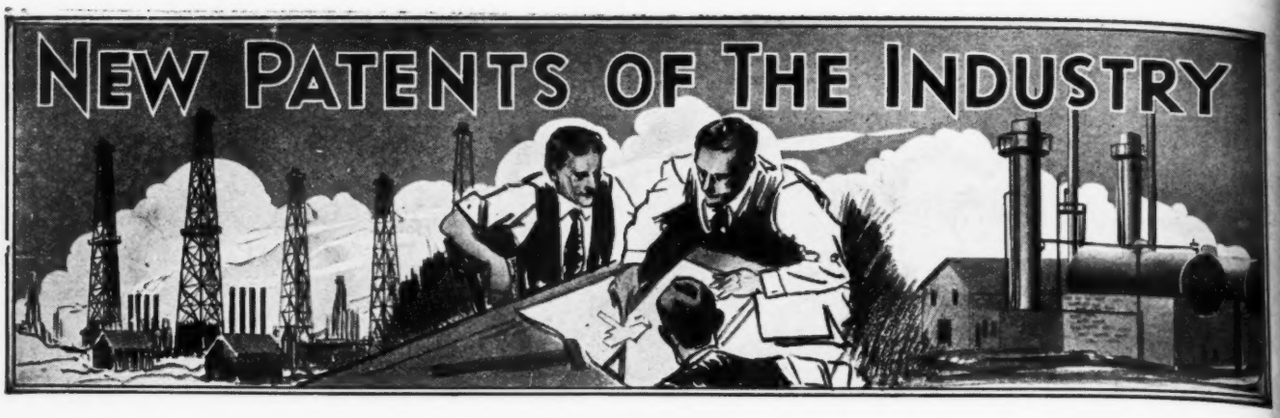
An oil sand requires varying pressures, according to the porosity, saturation, and water content; but as a general rule, it is safe to state that 1,000 cubic feet of air or gas per foot of sand is about the proper amount. In our experience, we have found only three or four properties that could not be successfully repressured, and these only because of high pressures, water, or a lens or unusually silty sand. With the experience and information gained in the last eight or ten years, it is now possible to determine, beforehand, the pressure that will be required, the possible increase in oil and gas production and the expense per barrel for installation and the lifting costs.

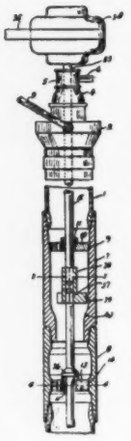
My opinion is that, in the near future, the shallow sand fields will come back stronger than ever because of their great potential production and the low cost of recovery and low initial cost. An acre foot of sand, with 16 per cent porosity and 75 per cent saturation, will contain just as much oil if it is in a 600-ft. sand as if it were in a 6,000-ft. one. We find that one can, if necessary, drill wells as close together as 100 feet, up to 1,000 feet in depth, in order to reclaim more oil with the recovery cost still less than 50 cents per barrel, including development and operation costs. We estimate, by drilling wells as close together as 100 feet, using a combination air drive and water flood, that 65 per cent of the oil reserves in shallow fields can be recovered. Then, if more oil is needed, we can go further and mine the sand, bring it to the top, extract the last drop and sell the sand for industrial uses.



The Aftercoolers for cooling high-pressure gas.

NEW PATENTS OF THE INDUSTRY



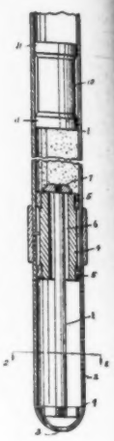


1,858,249. FAST ROTATING WELL DRILL. FLOYD L. SCOTT and LEWIS E. GARFIELD, Houston, Tex., assignors to Hughes Tool Company, Houston, Tex., a Corporation of Texas. Filed March 9, 1931. Serial No. 521,053. 8 Claims. (Cl. 255—28.)

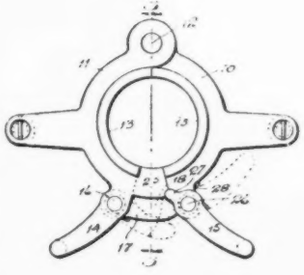
5. A drill pipe, a bit thereon, a drive-shaft axially of said pipe, bearings in said pipe for said shaft, a motor at the upper end of said shaft, said shaft being detachably connected with said bit whereby said bit may be rotated independently of said pipe.

1,857,301. APPARATUS AND PROCESS FOR CEMENTING WELLS. JASPER A. HARDCASTLE, Damon, Tex., assignor, by direct and mesne assignments, of one-fourth to Jesse H. Hardcastle, Houston, Tex., and one-fourth to R. L. Waxler. Filed July 1, 1929. Serial No. 375,040. 13 Claims. (Cl. 166—1.)

1. The combination with a casing in a well bore, of an upper plunger and a lower plunger fitted in the casing and spaced apart to receive a load of plastic cementitious material between them, said lower plunger having a vertical passageway therethrough, a valve normally closing said passageway, and means for opening the valve at the lower end of the casing to permit the discharge of said load through said passageway.

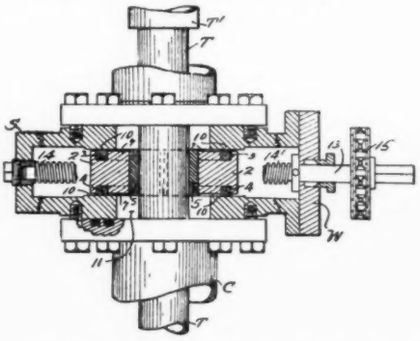


1,861,473. CASING ELEVATOR. JOHN E. HOFFOSS, Houston, Tex., assignor to W-K-M Company, Inc., Houston, Tex., a Corporation of Texas. Filed Dec. 26, 1930. Serial No. 504,702. Five Claims. (Cl. 294—90.)

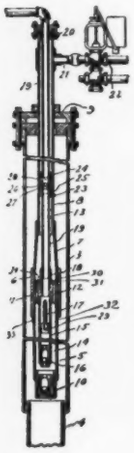


1. In a device of the class described, the combination of a plurality of members pivotally connected, one of the members being provided with a keeper and the other member being provided with a loop-shaped latch adapted to engage the keeper when closed, a U-shaped handle pivoted on the member which carries the keeper, said handle being provided on its inner end with a member normally underlying the free end of said loop-shaped latch and adapted when the handle is swung to swing the latch outwardly and disengage the same from the keeper, and a fixed U-shaped handle secured to the latch carrying member and between the legs of which said latch is pivoted, a spring for normally holding the free end of the latch inwardly, and a spring for normally holding the latch engaging member inwardly.

1,861,614. CASING CONTROL GATE. FRANK J. SCHWEITZER, Brea, Calif., assignor to William D. Shaeffer, Brea, Calif. Filed Oct. 14, 1930. Serial No. 488,572. Five Claims. (Cl. 251—159.)



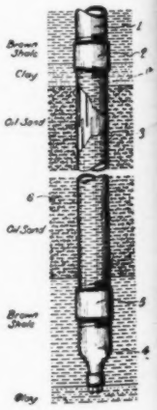
1. In a casing shut-off control, a rubber packing body including a diametrical portion with an obverse face to set against an opposed part and from which portion integrally extend lateral, parallel half-ring laps in spaced relation and adapted to be snapped into corresponding ring grooves in a complementary ram element, the said laps extending uni-directionally from the reverse face of said portion.



1,861,843. GAS LIFT PUMP. GEORGE E. DENMAN, Oakland, California. Filed Jan. 30, 1929, Serial No. 336,098. Renewed Nov. 13, 1931. Four Claims. (Cl. 103—231.

1. In an air or gas lift displacement pump, the combination with an outer casing adapted to extend from top to the bottom of a well and to enclose a pressure chamber, a closure cap at the top of the outer casing, and a check-valve at the bottom of the outer casing, of a removable inner outlet conduit extending within the outer casing, a check-valve at the lower extremity of the inner outlet conduit and adjacent to the first-named check-valve within the outer casing, a pressure nozzle within and concentric with the lower portion of the inner outlet conduit, means for admitting air or gas pressure to the chamber formed by the outer casing and inner conduit, and booster valves disposed along the inner outlet conduit for admitting a boosting pressure therein.

1,861,722. OIL WELL STRAINER. HAROLD EDWIN SEARLE, Jersey City, N. J., assignor, by mesne assignments, to The International Nickel Company, Inc., New York, N. Y., a Corporation of Delaware. Filed Oct. 24, 1927. Serial No. 228,242. Nine Claims. (Cl. 166—5.)



1. In a device for separating liquids from solids, the combination of a tube of relatively thick metal having elongated slots therein, and a cylindrical sheath of relatively thin metal having a smooth inner surface contiguous with and fitting about said tube and having elongated perforations at an acute angle to and in overlapping relation with the slots in said tube, one side of said perforations being wider than the other side thereof, said perforations and said slots being adapted to overlap irrespective of the relative positions of the sheath and tube.